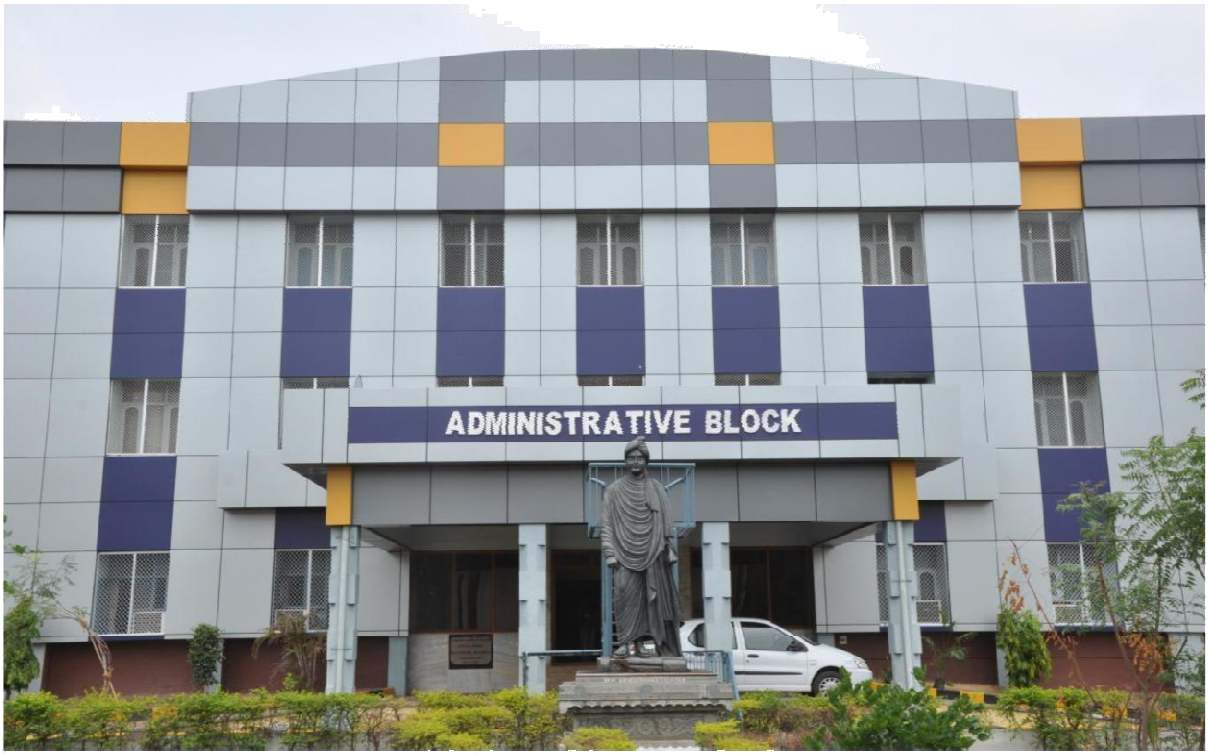

Scheme – 2023

Department of Emerging Technologies in Computer Science

G. Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for II Year of FOUR YEAR B.Tech. Degree Course in

CSE (Artificial Intelligence & Machine Learning)

(With Effect from the Batch Admitted in 2023-24)

G. PULLA REDDY ENGINEERING COLLEGE (Autonomous) : KURNOOL

SCHEME -23

B. TECH – CSE(AI & ML)

Applicable from the Academic Year 2023-24 onwards

B.Tech - Third Semester: CSE(AI & ML)

S.No	Category	Title	L/D	T	P	Credits	CIA	End Exam	Total Marks
1	BS&H	Universal Human Values	2	1	0	3	30	70	100
2	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3	30	70	100
3	ES	Artificial Intelligence	3	0	0	3	30	70	100
4	PC	Advanced Data Structures & Algorithms Analysis	3	0	0	3	30	70	100
5	PC	Object Oriented Programming Through Java	3	0	0	3	30	70	100
6	PC	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	Object Oriented Programming Through Java Lab	0	0	3	1.5	30	70	100
8	SC	Soft skills	0	1	2	2	30	70	100
9	AC	Environmental Science	2	0	0	-	0	0	0
		Total	**16**	**2**	**8**	**20**			

B.Tech - Fourth Semester: CSE(AI & ML)

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	BS&H	Optimization Techniques	2	0	0	2	30	70	100
2	BS&H	Probability & Statistics	3	0	0	3	30	70	100
3	PC	Machine Learning	3	0	0	3	30	70	100
4	PC	Database Management Systems	3	0	0	3	30	70	100
5	ES	Digital Logic & Computer Organization	3	0	0	3	30	70	100
6	PC	Machine Learning Lab	0	0	3	1.5	30	70	100
7	PC	Database Management Systems Lab	0	0	3	1.5	30	70	100
8	SC	Python Programming	0	1	2	2	30	70	100
9	BS&H	Design Thinking & Innovation	1	0	2	2	30	70	100
		Total	**15**	**1**	**10**	**21**			
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation									

Category:

BS&H : Basic Sciences & Humanities

ES : Engineering Sciences

PC : Professional Core

SC : Skill Enhancement Course

AC : Audit Course

L/D : Lecture / Design / Drawing

T/P : Theory / Practical

CIA : Continuous Internal assessment

UNIVERSAL HUMAN VALUES (UHV)

III/IV Semester: Common to all branches					Scheme : 2023			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
HSM 201	BS&H	2	1	0	3	30	70	100
Sessional Exam Duration : 2 Hrs					End Exam Duration :3 Hr			

Course Outcomes :At the end of the course, students will be able to	
CO1:	Define the terms like Natural Acceptance, Happiness and Prosperity
CO2:	Identify one's self, and one's surroundings(family, society nature)
CO3:	Apply what they have learnt to their own self in different day-to-day settings in real life
CO4:	Relate human values with human relationship and human society.
CO5:	Justify the need for universal human values and harmonious existence
CO6:	Develop as socially and eco logically responsible engineers

UNIT – I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity–the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial3: Practice Session PS3 Exploring Natural Acceptance

UNIT – II

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body. Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT – III

Harmony in the Family and Society (6 lectures and 3tutorials for practice session)

Lecture 13: Harmony in the Family–the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal

UNIT – IV

Harmony in the Nature/Existence (4lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT – V

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, ANagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N.Tripathi, New Age Intl. Publishers, NewDelhi,2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-

	Harmony%20in%20the%20Human%20Being.pdf
3.	https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4.	https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5.	https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

DISCRETE MATHEMATICS & GRAPH THEORY (DMGT)

III Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS201	BS&H	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hours | **End Exam Duration:** 3 Hours

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

CO1: Apply mathematical logic to solve problems.

CO2: Perform operations related to set theory and algebraic structures.

CO3: Apply basic counting techniques to solve combinatorial problems.

CO4: Solve recurrence relations by using substitution methods and generating functions.

CO5: Solve problems related to trees and graphs.

UNIT– I

Mathematical Logic

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Equivalence, Duality law, Implications, Functionally complete set of connectives, Normal Forms, Inference Theory of Statement Calculus.

UNIT– II

Set theory

The Principle of Inclusion- Exclusion, Pigeon hole principle and its application.

Functions: Composition of Functions, Inverse Functions.

Algebraic structures: Algebraic systems-Examples and General Properties, Semigroups and Monoids, groups, sub groups, homomorphism, Isomorphism.

UNIT– III

Elementary Combinatorics

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions.

UNIT– IV

Recurrence Relations

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

UNIT– V

Graphs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs.

Text Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

2. Joe L.Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.

Web References:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ARTIFICIAL INTELLIGENCE (AI)

III Semester: CSE (AI&ML)						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
CM201	ES	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1: Understand the fundamental concepts of Artificial Intelligence.

CO2: Solve problems by applying suitable search method.

CO3: Identify the methods to represent, propagate and infer uncertainty.

CO4: Understand the logic concepts and various learning methods.

CO5: Understand the concept of expert systems and their real-time applications.

UNIT– I

Introduction: AI problems, foundation of AI and history of AI
Intelligent agents: Agents and Environments, the concept of rationality, the nature of environments structure of agents, problem solving agents, problem formulation.

UNIT– II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search Search with partial information (Heuristic search) Hill climbing,A*,AO* Algorithms, Problem reduction Games, mini-max algorithm, optimal decisions in multiplayer games,Alpha-Beta pruning, Evaluation functions.

UNIT– III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance,representing knowledge using rules, rules based deduction systems.Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempstershafer theory.

UNIT– IV

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT– V

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Text Books:

1.S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education.

2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press.

2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth

Edition, Pearson Education.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Web References:

1. https://ai.google/
2. https://swayam.gov.in/nd1_noc19_me71/preview

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of four questions and all questions are compulsory. Question No.1 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The question paper shall contain six questions and all questions are compulsory. Question No.1 shall contain ten short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

ADVANCED DATA STRUCTURES & ALGORITHMS ANALYSIS (ADSA)

III Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS — **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS202	PC	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hours — **End Exam Duration:** 3 Hours

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

CO1: Understand the operations on Advanced Data Structures and analyze complexities of algorithms

CO2: Understand Graphs and String searching algorithms

CO3: Demonstrate Divide & Conquer and Greedy techniques

CO4: Apply Dynamic Programming technique to solve optimization problems.

CO5: Solve problems using Backtracking & Branch and Bound techniques.

UNIT– I

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.
AVL Trees – Creation, Insertion, Deletion operations and Applications.
B-Trees – Creation, Insertion, Deletion operations and Applications.
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications.

UNIT– II

Graphs – Terminology, Representations, Basic Search and Traversals - BFS, DFS, Biconnected Components & DFS.
String Searching Algorithms:
Brute-Force algorithm, Robin-Karp algorithm, Boyer-Moore algorithm.

UNIT– III

Divide and Conquer – The General Method, Quick Sort, Merge Sort, MaxMin problem, Strassen's matrix multiplication.
Greedy Method – General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths.

UNIT– IV

Dynamic Programming – General Method, Multistage Graph – Forward approach and Backward approach, All pairs shortest paths, Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem.

UNIT– V

Backtracking – General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, Hamiltonian Cycle problem
Branch and Bound – The General Method, Job Sequencing with deadlines problem, 15 Puzzle problem, Travelling Salesperson problem.

Text Books:

1. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni & Sanguthevar

Rajasekaran Universities Press, 2nd Edition or Galgotia

2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson, Second Edition 2005

3. Algorithms in C, Robert Sedge wick, Addison-Wesley Publishing Company, 2016

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia.

2. Introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.

4. Algorithms + Data Structures & Programs:, N.Wirth, PHI.

Web References:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. https://www.youtube.com/playlist?list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O
4. https://www.slideshare.net/slideshow/design-and-analysis-of-algorithms-lecture-notes/267127777

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA (OOPJ)

III Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
CS203	PC	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1: Understand Object Oriented Programming concepts and the fundamental constructs of Java.

CO2: Apply Inheritance, Packages and Interfaces to solve problems.

CO3: Demonstrate String handling methods and Exception handling mechanism.

CO4: Develop programs using Multithreading and Java Data Base Connectivity.

CO5: Understand Collection interfaces and Collection classes.

UNIT– I

Object Oriented concepts:
Overview of Java, Java buzzwords, Object oriented principles.

Programming Constructs:
Data types- byte, short, int, long, float, double, char, boolean, Operators- Assignment Operator (=), Arithmetic Operators, Increment (++) and Decrement (--) Operators, Ternary Operator, Relational Operators, Logical Operators, Bitwise Operators, Precedence and Associativity of Operators.
Control Statements- If, Switch, Iteration Statements, Nested loops, For–Each loop, Break Statement, Continue Statement.

Introduction to Classes:
Classes and Objects, Methods, Constructors, Reading Console input, Writing Console output, this keyword, Garbage collection, finalize and Wrapper classes.

UNIT– II

Inheritance:
Process of Inheritance, Object Class, Access Control, Types of Inheritance- Single level and Multilevel Inheritance, Multiple and Hierarchical Inheritance, Hybrid Inheritance, Final and Super keywords, Method Overloading, Dynamic Method Dispatch.

Interfaces:
Abstract Classes, Defining an interface and Implementing interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces**.**

Packages:
Defining Package, Importing Packages and Classes into Programs, Packages in Java SE- java.lang Package, Enumeration, Math class, Java util Classes and Interfaces, Formatter Class, Random Class, Formatting for Date/Time in Java.

UNIT– III

String Handling:
String constructors, String methods-Character extraction, String comparison, Searching strings and Modifying strings. StringBuffer class and its methods. StringBuilder class and its methods, Comparison of String, StringBuffer and StringBuilder.

Exception Handling:
Introduction, Types of Exceptions, Hierarchy of Built in exceptions, Keywords -try, catch, throw, throws and finally. Multi catch blocks, Java built-in exceptions, Creating customized exceptions.

UNIT– IV

Multithreading:
Java thread model, Creating a thread- Extending Thread class and Implementing Runnable interface, Thread life cycle, Thread class methods, Thread priorities, Deadlocks in Threads, Thread Synchronization and Inter Thread Communication.

Java Data Base Connectivity:
JDBC Architecture, JDBC Drivers, JDBC steps, Driver Manager class, Connection, Statement, ResultSet and PreparedStatement.

UNIT– V

Collections Framework:
Collection Interfaces- List,Set,SortedSet, Queue, Deque. Collection Classes- ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, PriorityQueue and ArrayDeque.
Accessing a Collection using an Iterator, The For-Each Alternative to Iterators.

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1.The complete Reference Java, 11th edition, Herbert Schildt, TMH
2.Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Web References:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

Question Paper Pattern:

Sessional Examination:
The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:
The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ADVANCED DATA STRUCTURES & ALGORITHMS ANALYSIS LAB (ADSA (P))

III Semester: Common to CSE, CSE (AI&ML) & CSBS — **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS204	PC	0	0	3	1.5	30	70	100

End Exam Duration: 3 Hours

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

CO1: Implement the operations on AVL tree, B-Tree, Heaps and Graphs.

CO2: Implement String Processing methods.

CO3: Solve the problems using Divide-and-Conquer technique.

CO4: Develop programs using Greedy and dynamic programming methods.

CO5: Solve N-Queens problem using backtracking.

List of Experiments

1. Construct an AVL tree for a given set of elements which are stored in a file and implement insert and delete operation on the constructed tree.
2. Construct B-Tree and Implement searching, insertion and deletion operations.
3. Implement a program to sort the elements of an array using Heap sort technique.
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
5. Implement the string processing algorithms- Brute Force & Boyer Moore methods.
6. Implement Quick sort and Merge sort using Divide and conquer technique and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Implement Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Fractional knapsack problem and Job sequencing with deadlines problem using Greedy strategy.
9. Write a program to solve All pairs shortest paths problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.

References:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, Sahni Sartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, 2nd Edition, University Press.
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia.
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill.

Web References:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (OOPJ(P))

III Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CS205	**PC**	**0**	**0**	**3**	**1.5**	**30**	**70**	**100**
						End Exam Duration: 3 Hours		

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

CO1: Implement Method overloading and Constructor overloading.

CO2: Implement Inheritance , Packages and Interfaces concepts.

CO3: Implement String handling methods and Exception handling.

CO4: Implement multithreading and collections concepts.

List of Experiments

1) Programs to implement class and object mechanism
a) Create a class, methods and invoke them inside main method.
b) Write a program to implement method overloading.
c) Write a program to implement constructor overloading.

2) Programs to implement Inheritance
a) Write a program to implement Single-level Inheritance.
b) Write a program to implement Multi-level and Hierarchical Inheritance.
c) Write a program creating an abstract class to find areas of different shapes.
d) Write a program to implement Multiple inheritance using interfaces.

3) Write a program to implement Dynamic Method Dispatch.

4) Write a program that imports and uses the user defined packages.

5) Write a program on String handling methods.

6) Programs to implement Exception handling mechanism
a) Write a program Illustrating Multiple catch blocks.
b) Write a program for handling Java Built-in Exceptions.
c) Write a program for handling User Defined Exception.

7) Programs to implement Multi threading concepts
a) Write a program to create threads by extending Thread class. First thread displays "Good Morning" every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable).
b) Write a program illustrating isAlive() and join() methods.
c) Write a program illustrating thread synchronization.
d) Write a program to solve Producer Consumer Problem using Inter Thread Communication.

8) Write a program to implement ArrayList, LinkedList and HashSet collections.

References:

1. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.
2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition 2007

3. Bruce Eckel, “Thinking in Java”, Pearson Education, 4th Edition, 2006.
4. Sachin Malhotra, Saurabh Chaudhary, “Programming in Java”, Oxford University Press, 5th Edition, 2010.

Web References:

https://java-iitd.vlabs.ac.in/

http://peterindia.net/JavaFiles.html

SOFT SKILLS (SS(P))

IV Semester: Common for all Branches						Scheme : 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
SCCM01	SC	0	1	2	2	30	70	100
						End Exam Duration: 3 Hrs		

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

CO1: Enhance teamwork and professional growth in engineering and related fields through foundational soft skills and practical communication proficiency

CO2: Develop effective presentation skills to meet industry standards, enabling clear and professional communication of ideas and information

CO3: Develop the ability to identify and employ a variety of problem-solving and decision-making methods that is relevant and effective in real-world situations

CO4: Develop and apply emotional intelligence and stress management techniques to enhance personal, professional well-being and emotional well-being

CO5: Understand and develop the corporate etiquette necessary to present themselves in a professional setting

UNIT – I	
Soft Skills & Communication Skills	**Soft Skills** - Introduction, Need - Mastering Techniques of Soft Skills – Communication. Skills -Significance, process, types - Barriers of communication - Improving techniques
Activities	**Intrapersonal Skills**- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity. (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources) – Stake holders Management **Interpersonal Skills**- Group Discussion – Debate – Team Tasks - Book and film reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. **Verbal Communication**- Extempore- brief addresses and speeches convincing- negotiating- agreeing and disagreeing with professional grace. **Non-verbal communication** – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation
UNIT - II	
Presentation Skills	Types of presentations-Delivery techniques – Engaging the audience – Handling Q&A and feedback – Research Content – Visual aids and materials
Activities	Poster Presentation Power Point Presentation Oral Presentation
UNIT – III	
Problem Solving &	Meaning & features of Problem Solving – Managing Conflict – Conflict

Decision Making	resolution – Team building - Effective decision making in teams – Methods & Styles
Activities	Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision
UNIT - IV	
Stress Management	Self-awareness –Self-Regulation – Stress factors – Controlling Stress – Tips
Activities	Providing opportunities for the participants to narrate certain crisis and stress – ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates
UNIT - V	
Corporate Etiquette	Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- e-mail etiquette - Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips - Overcoming challenges
Activities	Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

Text Books

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018.

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018
2. Alex K, Soft Skills S.Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

Web References:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ

ENVIRONMENTAL SCIENCE (ES)

III/IV Semester : Common to all Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC201	BS&H	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	0	100	--	100

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

CO1: Apply the knowledge of environmental issues in area of work. Interpret the need for the conservation of Natural resources for sustainable development.

CO2: Pursue the importance of Ecosystem and conservation of biodiversity

CO3: Assess the problems due to environmental pollution with remedial measures and issues related to environment.

CO4: Evaluate sustainable development and address environmental issues.

CO5: Interpret the use of IT & related technology to conserve environment & human health.

UNIT – I

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems. Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people. Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems. Food resources – World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer, pesticide problems, water logging, salinity, case studies. Energy resources – solar, wind and nuclear energy resources.

UNIT – II

Ecosystems: Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers. Energy flow in the ecosystem – Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and functions of the forest and aquatic (pond and ocean) ecosystems.

Biodiversity and its Conservation: Introduction, Definition: genetic, species and ecosystem diversity. Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, cause, effects and control measures of :

a. Air Pollution.

b. Water pollution
c. Noise pollution
d. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution – Pollution case studies. Disaster management: floods, earthquake and cyclone.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting – Environmental ethics. Global issues and possible solutions – Climate change, global warming, acid rain and ozone layer depletion – Case Studies. Consumerism and waste products. Environment Protection Acts – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act. Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population and the Environment: Population growth, Population explosion – Family Welfare Programmes. – Environment and human health. Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health.

Field Work: Visit to a local area to document environmental assets River/forest/grassland/ hill/mountain – Visit to a local polluted site – Urban/Rural/Industrial/Agricultural study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. C. P. Kaushik and Anubha Kaushik, “Environmental Studies” New Age International (P) Ltd., New Delhi.
2. Erach Bharucha, “Textbook of Environmental Studies for Undergraduate Courses” University Grants Commission, Universities Press.
3. Y. Anjaneyulu “Introduction to Environmental Sciences”, BS Publications, Hyderabad.
4. R. Rajagopalan, “Environmental Studies”, Oxford University Press, Chennai.
5. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company.

References:

1. Benny Joseph, “Environmental Studies”, Tata McGraw Hill, New Delhi.
2. Decksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
3. M. Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
4. Palaniswamy, “Environmental Studies”, Pearson Education.
5. J. P. Sharma, “Comprehensive Environmental Studies”, Laxmi Publications.
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science”, Prentice Hall of India Private limited.

OPTIMIZATION TECHNIQUES (OT)

IV Semester: Common to CSE (AI&ML) & CSE(DS)					Scheme: 2023			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME 214	BS&H	2	0	0	2	30	70	100
Sessional Exam Duration: 2 Hours					End Exam Duration: 3 Hours			

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

CO1: Understand the concept of Optimization,Formulation and solve Linear Programming problems

CO2: Solve Transportation & Assignment Models

CO3: Solve the sequencing problems

CO4: Formulate and solve gaming problems

CO5: Solve the project management problems

UNIT– I

Introduction: Introduction: Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical method, Simplex method: Maximization and Minimization model (exclude Duality problems), Big-M method.

UNIT– II

Transportation Problem: Introduction, Transportation Model, Finding initial basic feasible solutions Moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy

Assignment Problem: Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems Maximization in Assignment Model.

UNIT– III

Sequencing: Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, Two jobs and m Machines Problems.

UNIT– IV

Game Theory : Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application

UNIT– V

Project Management: Network Analysis – Definition –objectives -Rules for constructing network diagram- Determining Critical Path – Earliest & Latest Times – Floats – Application of CPM and PERT techniques in Project Planning and Control – PERT Vs CPM. (exclude Project Crashing).

Text Books:

1. Operations Research / R.Pannerselvam, PHI Publications
2. Operations Research / S.D.Sharma-Kedarnath
3. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.

4. Engineering Optimization: Theory and practice / S.S.Rao, New Age International (P) Limited

References:

1. Quantitative Techniques in Management / ND Vohra, Tata McGraw Hill, 4th Edition, 2011.
2. Introduction to O.R/Hiller &Libermann (TMH).
3. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan& Lawrence Friedman. Pearson
4. Quantitative Analysis For Management/ Barry Render, Ralph M. Stair, Jr and Michael E. Hanna
5. Operations Research / Wagner/ PHI Publications

Web References:

1. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of four questions and all questions are compulsory. Question No.1 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The question paper shall contain six questions and all questions are compulsory. Question No.1 shall contain ten short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

PROBABILITY & STATISTICS (PS)

IV Semester: Common to CSE, CSE (AI&ML) & CSBS | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
BS202	BS&H	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hours | **End Exam Duration:** 3 Hours

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

CO1: Determine Statistical constants, correlation coefficient and regression lines by applying the method of Least Squares..

CO2: Acquire knowledge on probability and identifying the discrete and continuous random variables.

CO3: Apply the theoretical probability distributions in the relevant areas.

CO4: Analyze test of hypotheses for large samples.

CO5: Analyze test of significance for small samples.

UNIT– I

Descriptive Statistics: Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance), correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT– II

Probability: Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT– III

Probability distributions: Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution

UNIT– IV

Estimation and Testing of hypothesis, Large Sample Tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.

UNIT– V

Small Sample Tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Text Books:

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MACHINE LEARNING (ML)

IV Semester: CSE(AI&ML)						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM202	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1: Understand the core principles of Machine Learning

CO2: Build an application of nearest neighbor algorithms to effectively to solve problems

CO3: Implement decision trees and Naive Bayes classifiers to address diverse machine learning tasks.

CO4: Implement applications using linear discriminant analysis (LDA) for enhanced classification.

CO5: Develop unsupervised models for clustering data

UNIT– I

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT– II

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT– III

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Naive Bayes Classifier (NBC).

UNIT– IV

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT– V

Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Clustering Algorithms, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering.

Text Books:

1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024.

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017.
2. Aurelian Geron, "Hands-On: Machine Learning with Scikit Learn and Tensor Flow:Concepts, Tools and Techniques to build Intelligent Systems", Oreilly Publications, First Edition, 2017
3. "Machine Learning in Action",Peter Harrington, DreamTech.
4. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

Web References:

1. https://intellipaat.com/blog/tutorial/machine-learning-tutorial/
2. https://nptel.ac.in/courses/106/106/106106139/

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of four questions and all questions are compulsory. Question No.1 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The question paper shall contain six questions and all questions are compulsory. Question No.1 shall contain ten short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

DATABASE MANAGEMENT SYSTEMS (DBMS)

IV Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
CS207	PC	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1: Understand the basic concepts of database management systems.

CO2: Analyze a given database application scenario to use ER model for conceptual design of the database.

CO3: Utilize SQL proficiently to address diverse query challenges.

CO4: Employ normalization methods to enhance database structure.

CO5: Understand transaction processing concepts in databases.

UNIT– I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Database system structure, environment.
Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, specialization, generalization using ER Diagrams.

UNIT– II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT– III

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, relational set operations.

UNIT– IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency, (1NF, 2NF and 3 NF), Boyce-Codd normal form(BCNF), Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT– V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, Deadlocks, Failure Classification, Storage, Recovery and Atomicity.

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For

Chapters 2, 3, 4)

2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:

1) Introduction to Database Systems, 8thedition, C J Date, Pearson.

2) Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson

3) Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022.

Web References:

1).https://nptel.ac.in/courses/106/105/106105175/

2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

Question Paper Pattern:

Sessional Examination

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

DIGITAL LOGIC & COMPUTER ORGANIZATION(DLCO)

III/IV Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
EC211	ES	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1: Apply the knowledge of number systems, logic functions and Boolean algebra in the realization of various combinational circuits.

CO2: Design the sequential circuits using flip-flops and logic gates.

CO3: Analyze the structural components of a basic computer, concepts of processor organization and various computer arithmetic algorithms used in the design of a basic computer.

CO4: Analyze the fundamental concepts of memory organization.

CO5: Analyze the fundamental concepts of i/o organization and interrupt handling.

UNIT– I

Data Representation: Binary Numbers, Fixed Point Representation, Floating Point Representation, Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes.

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers.

UNIT– II

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters.

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von-Neumann Architecture.

UNIT– III

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Micro programmed Control.

UNIT– IV

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT– V

Input/output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Text Books:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.

Reference Books:

1. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson.
2. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson.
3. Computer Organization and Design, David A. Paterson, John L.Hennessy, Elsevier.
4. Fundamentals of Logic Design, Roth, 5thEdition, Thomson

Online Learning Resources:

https://nptel.ac.in/courses/106/103/106103068/

Question Paper Pattern:

Sessional Examination:

The question paper for Sessional Examination shall be for 30 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MACHINE LEARNING LAB(ML(P))

IV Semester: CSE(AI&ML)						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
CM203	PC	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		0	0	3	1.5	30	70	100
						End Exam Duration: 3 Hours		

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

CO1: Apply pre-processing techniques for a given dataset.

CO2: Implement Classification, Regression and clustering Models.

List of Experiments

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
   a. Attribute selection
   b. Handling Missing Values
   c. Discretization
   d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression.
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results.
5. Apply Random Forest algorithm for classification.
6. Demonstrate Naïve Bayes Classification algorithm.
7. Apply Support Vector algorithm for classification.
8. Demonstrate simple linear regression algorithm for a regression problem.
9. Apply Logistic regression algorithm for a classification problem.
10. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

List of Additional Experiments

1. Implement any four data visualization techniques on public domain datasets.
2. Apply Ensemble Learning.

References:
1. “Machine Learning Theory and Practice”, M N Murthy, V S Ananthanarayana, Universities Press (India), 2024.
2. Aurelian Geron, “Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts,Tools, and Techniques to build Intelligent Systems”, OReilly Publications, First Edition, 2017
Web References:
1. https://www.javatpoint.com/machine-learning.
2. https://www.geeksforgeeks.org/learning-model-building-scikit-learn-python-machine-learning-library/
3. https://nptel.ac.in/courses/106/106/106106139/

DATABASE MANAGEMENT SYSTEMS LAB (DBMS (P))								
IV Semester: Common to CSE, CSE (AI&ML), CSE(DS) & CSBS						**Scheme:**2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CS210	PC	0	0	3	1.5	30	70	100
						End ExamDuration:3 Hours		

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

CO1: Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment.

CO2: Constructing and execute queries to manipulate and retrieve data from databases.

CO3: Develop application programs using PL/SQL.

CO4: Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality.

List of Experiments

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.

2. Queries (along with sub-Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS,UNION, INTERSET, Constraints. Example: - Select the roll number and name of the student who secured fourth rank in the class.

3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

4.Queries using Conversion functions (to_char, to number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).

5 i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR

8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

10.Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE

CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.
References
1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007
4. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
5. Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022.
Web References:
1.http://www.scoopworld.in
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

PYTHON PROGRAMMING (PYP)

(Skill Enhancement Course)

III/IV Semester: Common for all branches except CE — **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
SCCM02	SC	0	1	2	2	30	70	100

End Exam Duration: 3 Hours

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

CO1: Apply the concepts of Python syntax, variables, data types, control structures, functions, modules and exception handling to solve given problems.

CO2: Develop programs using Python functions, strings and lists.

CO3: Identify the applications of dictionaries, tuples and sets in python programming.

CO4: Implement files and object oriented programming concepts.

CO5: Implement commonly used Python libraries and frameworks such as JSON, XML, NumPy, and pandas

UNIT– I

Introduction:
History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook. Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements,
Exception Handling: Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators
   iv) Logical Operators v) Bitwise Operators vi) Ternary Operator vii) Membership Operators
   viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print a multiplication table of a given number.

UNIT– II

Functions:
Built-in functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings:
Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, and Formatting Strings.

Lists:
Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statements.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list: a) Addition b). Insertion c). Slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT– III

Dictionaries:
Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets:
Creating Tuples, Basic Tuple Operations, tuple () Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members concatenate the tuples, and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT– IV

Files:
Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python OS and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT– V

Introduction to Data Science:
Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

23. Python program to check whether a JSON string contains complex object or not.
24. Python Program to demonstrate NumPy arrays creation using array () function.

25. Python program to demonstrate use of ndim, shape, size, dtype.
26. Python program to demonstrate basic slicing, integer and Boolean indexing.
27. Python program to find min, max, sum, cumulative sum of array
28. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
29. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Text Books:

1. Gowri Shankar S, Veena A., Introduction to Python Programming, CRC Press
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Reference Books:

1. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey, Apress.
2. Python -The Ultimate Beginner's Guide! , Andrew Johansen.

Web References:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

DESIGN THINKING & INNOVATION (DTI)

III/IV Semester:Common for all Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ESCM01	ES	1	0	2	2	30	70	100

End Exam Duration: 3 Hrs

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

CO1:	Define the concepts related to Design thinking
CO2:	Explain the fundamentals of Design Thinking and innovation
CO3:	Apply the design thinking techniques for solving problems in various sectors
CO4:	Analyse to work in a multidisciplinary environment
CO5:	Formulate specific problem statements of real time issues

UNIT – I

Introduction to Design Thinking: Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT – II

Design Thinking Process: Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT – III

Innovation: Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT – IV

Product Design: Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT – V

Design Thinking in Business Processes: Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. Tim Brown, Change by design, Harper Bollins (2009)

2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons

Reference Books:
1. David Lee, Design Thinking in the Classroom, Ulysses press
2.Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4.Chesbrough.H, The Era of Open Innovation – 2013
Online Resources:
1.https://nptel.ac.in/courses/110/106/110106124/
2.https://nptel.ac.in/courses/109/104/109104109/
3.https://swayam.gov.in/nd1_noc19_mg60/preview