B.Tech.–II Year I Semester

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24BS2105	Discrete Mathematics & Graph Theory	BS&H	3	0	0	3
2	BT24HS2101	Universal human values – understanding harmony and Ethical human conduct	BS&H	2	1	0	3
3	BT24ML2101	Artificial Intelligence	Engineering Science	3	0	0	3
4	BT24CS2101	Advanced Data Structures Algorithms Analysis	Professional Core	3	0	0	3
5	BT24CS2102	Object Oriented Programming through Java	Professional Core	3	0	0	3
6	BT24CS2103	Advanced Data Structures and Algorithms Analysis Lab	Professional Core	0	0	3	1.5
7	BT24CS2104	Object Oriented Programming Through Java Lab	Professional Core	0	0	3	1.5
8	BT24CS2105	Python Programming Lab	Skill Enhancement Course	0	1	2	2
9	BT24BS2106	Environmental Science	Audit Course	2	0	0	-
Total				**16**	**2**	**8**	**20**

B.Tech–II Year II Semester

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24BS2204	Optimization Techniques	Management Course-I	2	0	0	2
2	BT24BS2202	Probability & Statistics	Engineering Science/Basic Science	3	0	0	3
3	BT24ML2201	Machine Learning	Professional Core	3	0	0	3
4	BT24CS2202	Database Management Systems	Professional Core	3	0	0	3
5	BT24EC2208	Digital Logic & Computer Organization	Professional Core	3	0	0	3
6	BT24ML2202	Machine Learning Lab	Professional Core	0	0	3	1.5
7	BT24CS2205	Database Management Systems Lab	Professional Core	0	0	3	1.5
8	BT24CS2206	Full Stack Development-1	Skill Enhancement Course	0	1	2	2
9	BT24ME2207	Design Thinking & Innovation	Engineering Science	1	0	2	2
Total				**15**	**1**	**10**	**21**
10	Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24BS2105	L	T	P	C
		3	0	0	3
DISCRETE MATHEMATICS AND GRAPH THEORY					

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

Course Outcomes:

At the end of the course students will be able to

CO1: Build skills in solving mathematical problems (L3).

CO2: Comprehend mathematical principles and logic (L4).

CO3: Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L6).

CO4: Manipulate data numerically sing appropriate Software (L3).

CO5: Analyze data graphically sing appropriate Software (L4).

CO6: Understand the concept of spanning trees in graph (L2).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	3.00	2.00	-	-	-	-	2.00	-	-	-	2.00
CO2	3.00	3.00	1.00	-	-	-	-	2.00	-	-	-	2.00
CO3	3.00	3.00	2.00	-	-	-	-	2.00	-	-	-	2.00
CO4	3.00	3.00	2.00	-	-	-	-	2.00	-	-	-	-
CO5	3.00	2.00	1.00	-	-	-	-	2.00	-	-	-	2.00
CO6	3.00	3.00	2.00	-	-	-	-	2.00	-	-	-	2.00

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

UNIT–I: Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory:

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations:

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

Recurrence Relations:

Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

UNIT-IV: Graph Theory:

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

Unit-V: Multi Graphs

Multi graphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXTBOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics – A Computer Oriented Approach, C. L. Liuand D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCEBOOKS:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J.L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bern and Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S.K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24HS2101	L	T	P	C
		2	1	0	3
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT					

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students to wards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To high light plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

At the end of the course students will be able to

CO1: Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2).

CO2: Identify one's self, and one's surroundings (family, society nature) (L1, L2).

CO3: Apply what they have learnt to their own self in different day-to-day settings in real life (L3).

CO4: Relate human values with human relationship and human society (L4).

CO5: Justify the need for universal human values and harmonious existence (L5).

CO6: Develop as socially and ecologically responsible engineers (L3, L6).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	3.00	3.00	-	2.00	-	3.00
CO2	-	-	-	-	-	-	-	3.00	2.00	2.00	-	3.00
CO3	-	-	-	-	-	-	-	3.00	2.00	-	-	2.00
CO4	-	-	-	-	-	-	3.00	3.00	2.00	2.00	-	3.00
CO5	-	-	-	-	-	-	3.00	3.00	-	-	-	3.00
CO6	-	-	-	-	-	3.00	3.00	2.00	2.00	-	-	2.00

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

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

Lecture1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about One self

Lecture 3: self-exploration as the Process for Value Education

Lecture4: 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

Tutorial 3: 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.

Lecture8: 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

Lecture12: Programme to ensure self – regulation and Health

Tutorial6: 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

Lecture18: Vision for the Universal Human Order

Tutorial9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature / Existence (4 lectures and 2 tutorials for practice session)

Lecture19: Understanding Harmony in the Nature

Lecture 20: Inter connectedness, self-regulation and Mutual Fulfilment 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

Lecture22: The Holistic Perception of Harmony in Existence

Tutorial11: 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

Tutorial12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture26: Competence in Professional Ethics

Tutorial13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNITV – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic

foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

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
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3 S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202 25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24ML2101	L	T	P	C
		3	0	0	3
ARTIFICIAL INTELLIGENCE					

Pre-requisite:

1. Knowledge in Computer Programming.
2. A course on "Mathematical Foundations of Computer Science".
3. Back ground in linear algebra, data structures and algorithms, and probability.

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence.
2. The student should be made to learn the methods of solving problems using Artificial Intelligence.
3. The student should be made to introduce the concepts of Expert Systems.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. To learn different knowledge representation techniques.

Course Outcomes:

CO1: Describe the fundamental concepts, history, and foundations of Artificial Intelligence, including the structure of intelligent agents. (L2)

CO2: Apply uninformed and heuristic search algorithms to solve AI problems and simulate intelligent behavior in game-playing environments. (L3)

CO3: Analyze and compare different knowledge representation techniques such as predicate logic, semantic networks, and rule-based systems. (L4)

CO4: Evaluate reasoning under uncertainty using probabilistic methods like Bayesian inference and Dempster-Shafer theory. (L5)

CO5: Develop AI solutions using logic-based reasoning techniques, including forward/backward chaining, resolution, and learning models like decision trees and reinforcement learning (L3,L6).

CO6: Illustrate the architecture and functionalities of expert systems, and explain their applications in real-world problem solving (L3).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	-	-	-	-	-
CO2	3	2	3	2	3	-	-	-	-	-	-	1
CO3	3	3	2	-	2	-	-	-	-	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	2
CO5	3	3	3	2	3	-	-	-	1	2	2	2
CO6	3	2	3	2	2	-	-	-	1	2	-	2

	PSO1	PSO2
CO1	3	-
CO2	3	2
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3

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, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions

UNIT – III: Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempster shafer 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, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT – V: Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Textbooks:

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)", McGrawHill

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,“ArtificialIntelligence:AnewSynthesis”,ElsevierPublishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Online Learning Resources:

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

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24CS2101	L	T	P	C
		3	0	0	3
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS					

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes:

At the end of the course students will be able to

CO1: Analyze worst-case running times of algorithms using asymptotic analysis (L4).

CO2: Apply Divide-and-conquer paradigm and explain when an algorithmic design situation calls for it (L3).

CO3: Apply Greedy Method paradigm (L3).

CO4: Develop dynamic programming algorithms for various real time applications (L6).

CO5: Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms (L3).

CO6: Solve NP Completeness of problems (L5).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	3.00	3.00	-	3.00	-	-	-	-	-	-	-
CO2	-	2.00	3.00	-	-	-	-	-	-	-	-	-
CO3	2.00	-	-	2.00	-	-	-	-	-	-	-	-
CO4	-	-	2.00	3.00	-	-	-	-	-	-	-	-
CO5	2.00	-	-	-	3.00	-	-	-	-	-	-	-
CO6	-	3.00	-	3.00	2.00	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	3.00	-
CO2	-	2.00
CO3	-	3.00
CO4	2.00	-
CO5	1.00	2.00
CO6	2.00	-

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

UNIT–II:

Heap Trees (Priority Queues)–Min and Max Heaps, Operations and Applications

Graphs–Terminology, Representations, Basic Search and Traversals, Connected Components and Bi connected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT–III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT–IV:

Back tracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT–V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Sales person Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni,S artaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran 2nd Edition University Press

Reference Books:

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

2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald EKnuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs: ,N. Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. AbdulBari,1.IntroductiontoAlgorithms(youtube.com)

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24CS2102	L	T	P	C
		3	0	0	3

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object – oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development.

Course Outcomes:

At the end of the course students will be able to

CO1: Realize the concept of object oriented programming & Java programming constructs (L2).

CO2: Describe the basic concept of java such as operators, classes, objects (L2).

CO3: Describe the basic concept of java such as inheritance, packages, enumeration and various keywords (L2).

CO4: Apply the concepts of exception handling and Input / Output operations (L3).

CO5: Design the applications of Java & Java applet (L6)

CO6: Analyze & design the concept of Event handling and abstract window toolkit (L6)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	2.00	1.00	-	-	-	-	-	-	-	-
CO2	3.00	2.00	2.00	1.00	-	-	-	-	-	-	-	-
CO3	3.00	2.00	3.00	2.00	-	-	-	-	-	-	-	-
CO4	3.00	1.00	2.00	2.00	-	-	-	-	-	-	-	-
CO5	2.00	3.00	3.00	-	-	-	-	-	-	-	-	-
CO6	1.00	2.00	2.00	2.00	-	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	2.00	-
CO2	2.00	-
CO3	-	-
CO4	-	-
CO5	-	2.00
CO6	-	-

UNIT I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators : Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final.

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java. lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-un

boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: JavaI/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L. Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

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

Online Resources:

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

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)
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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24CS2103	L	T	P	C
		0	0	3	1.5
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB					

Course Objectives:

The objectives of the course is to

- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem – solving scenarios

Course Outcomes:

At the end of the course students will be able to

CO1: Analyze algorithms and determine algorithm correctness and time efficiency classes (L4)

CO2: Develop Programs for implementing trees and their traversal operations (L6)

CO3: Apply algorithm design techniques (L3)

CO4: Apply Greedy, divide and conquer algorithms (L3)

CO5: Develop dynamic programming algorithms for various real-time applications (L6)

CO6: Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms (L4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	3.00	3.00	3.00	3.00	-	-	-	-	-	-	2.00
CO2	3.00	3.00	3.00	-	-	-	-	-	-	-	-	3.00
CO3	3.00	-	-	3.00	3.00	-	-	-	-	-	-	2.00
CO4	3.00	3.00	3.00	3.00	-	-	-	-	-	-	-	3.00
CO5	3.00	-	-	-	3.00	-	-	-	-	-	-	3.00
CO6	3.00	3.00	-	3.00	3.00	-	-	-	-	-	-	2.00

	PSO1	PSO2
CO1	3.00	3.00
CO2	-	3.00
CO3	-	3.00
CO4	3.00	-
CO5	3.00	3.00
CO6	3.00	-

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum costs panning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Sales person problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

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. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the bi-connected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Back tracking.
11. Use Back tracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

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, Sanguthe var Rajasekaran, 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

Online Learning Resources:

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

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24CS2104	L	T	P	C
		0	0	3	1.5
OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB					

Course Objectives:

The aim of this course is to

- Practice object – oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity.
- Construct Threads, Event Handling, implement packages, Java FXGUI.

Course Outcomes:

At the end of the course students will be able to

CO1: Apply control structures and operators for writing basic python programs (L3).

CO2: List various python data structure concepts and apply them to solve real world problems (L3).

CO3: Develop functions and examine various file handling techniques and apply them to solve real world problems (L6).

CO4: Build simple Modules used for solving real world Problems (L6).

CO5: Analyze object oriented concepts in Python (L4).

CO6: Develop, test various GUI application (L6).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	1.00	2.00	2.00	-	-	-	-	-	-	2.00
CO2	3.00	2.00	2.00	2.00	3.00	-	-	-	-	-	-	3.00
CO3	3.00	2.00	3.00	2.00	2.00	-	-	-	-	-	-	2.00
CO4	3.00	3.00	1.00	2.00	3.00	-	-	-	-	-	-	3.00
CO5	3.00	2.00	3.00	2.00	2.00	-	-	-	-	-	-	3.00
CO6	3.00	3.00	3.00	2.00	3.00	-	-	-	-	-	-	2.00

	PSO1	PSO2
CO1	3.00	3.00
CO2	2.00	2.00
CO3	1.00	1.00
CO4	3.00	3.00
CO5	1.00	1.00
CO6	3.00	3.00

Experiments covering the Topics:

- Object Oriented Programming fundamentals – data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, Java FXGUI

Sample Experiments:

Exercise–1:

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise-2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program using String Buffer to delete, remove character.

Exercise-3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program implements method over loading.

c) Write a JAVA program to implement constructor.

d) Write a JAVA program to implement construct or over loading.

Exercise-4

a) Write a JAVA program to implement Single Inheritance

b) Write a JAVA program to implement multi – level Inheritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise-5

a) Write a JAVA program give example for "super" key word.

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

c) Write a JAVA program that implements Runtime polymorphism

Exercise-6

a) Write a JAVA program that describes exception handling mechanism

b) Write a JAVA program Illustrating Multiple catch clauses

- Write a JAVA program for creation of Java Built-in Exceptions
- Write a JAVA program for creation of User Defined Exception

Exercise-7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning" every 1sec, 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()**

c) Write a Program illustrating Daemon Threads.

d) Write a JAVA program Producer Consumer Problem

Exercise–8

1. Write a JAVA program that import and use the user defined packages
2. Without writing any code, build a GUI that display text in label and image in an Image View (use JavaFX)
3. Build a Tip Calculator app using several Java FX components and learn how to respond to user interactions with the GUI

Exercise–9

1. Write a java program that connects to a database using JDBC

b) Write a java program to connect to a database using JDBC and insert values in to it.

c) Write a java program to connect to a database using JDBC and delete values from it

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24CS2105	L	T	P	C
		0	1	2	2
PYTHON PROGRAMMING (Skill Enhancement Course)					

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expression sin Python Programming and to create practical and contemporary applications using these.

Course Outcomes:

At the end of the course students will be able to

CO1: Develop essential programming skills in computer programming concepts like datatypes, containers (L3)

CO2: Apply the basic of programming in the Python Language (L3)

CO3: Apply ode tasks related to conditional executions and loops (L3)

CO4: Apply coding tasks related to fundamental notations and techniques used in object oriented programming (L3)

CO5: Design and implement a program to solve a real world problem (L6)

CO6: Create a database connectivity in python programming language (L6)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	3.00	-	2.00	-	-	-	-	-	-	2.00
CO2	3.00	3.00	3.00	-	2.00	-	-	-	-	-	-	2.00
CO3	3.00	3.00	3.00	-	2.00	-	-	-	-	-	-	2.00
CO4	3.00	2.00	2.00	-	2.00	-	-	-	-	-	-	2.00
CO5	3.00	3.00	3.00	-	3.00	-	-	-	-	-	-	2.00
CO6	3.00	2.00	2.00	-	2.00	-	-	-	-	-	-	2.00

	PSO1	PSO2
CO1	3.00	3.00
CO2	2.00	2.00
CO3	3.00	3.00
CO4	2.00	2.00
CO5	3.00	3.00
CO6	3.00	3.00

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associatively, 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, 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 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 Life time 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, Formatting Strings.

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

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
    i. Addition ii. Insertion iii. slicing
6. 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, Usingzip( ) Function, Sets, SetMethods, Frozen set.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string(No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to small 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:

1. 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.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.

5. Write a program to add, transpose and multiply two matrices.
6. 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:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array() function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basics licing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. 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
7. 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

Reference Books:

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

Online Learning Resources / Virtual Labs:

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

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- I Semester	Course Code: BT24BS2106	L	T	P	C
		2	0	0	-
ENVIRONMENTAL SCIENCE					

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes:

At the end of the course students will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources (L3).

CO2: Understand flow and bio-geo-chemical cycles and ecological pyramids (L2).

CO3: Understand various causes of pollution and solid waste management (L2).

CO4: Understand the various causes of pollution and its related preventive measures (L4).

CO5: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation (L4).

CO6: Casus of population explosion, value education and welfare programmes (L3).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	3.00	-	-	3.00	2.00	-	2.00	2.00	-	3.00
CO2	3.00	2.00	-	-	-	3.00	2.00	-	3.00	3.00	-	3.00
CO3	3.00	-	-	-	-	2.00	3.00	-	2.00	2.00	-	3.00
CO4	2.00	-	2.00	-	-	2.00	3.00	-	2.00	2.00	-	3.00
CO5	2.00	2.00	2.00	-	-	2.00	3.00	-	2.00	2.00	-	3.00
CO6	2.00	2.00	2.00	-	-	3.00	3.00	-	2.00	2.00	-	2.00

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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–Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – 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:

UNIT–II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grass land ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation: Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels– India as a mega- diversity nation– Hot-sports 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. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. 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, cyclone and landslides.

UNIT–IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – 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, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

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. Text book of Environmental Studies for Undergraduate Erach Bharucha, Courses, Universities Press (India) Private Limited, 2019.
2. Palani swamy, Environmental Studies,2/e,Pearsoneducation,2014.
3. S. Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy,Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. Deeksha Daveand E. Sai Baba Reddy,Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
3. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.

4. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
5. J.Glynn Henry and Gary W.Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
6. G.R.Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
7. Gilbert M. Masters and Wendel lP. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24BS2204	L	T	P	C
		2	0	0	2
OPTIMIZATION TECHNIQUES					

Pre-requisite:

Course Objectives:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

Course Outcomes:

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

CO1: Formulate an engineering optimization problem with and without constraints using appropriate design variables.(L2)

CO2: Solve unconstrained and constrained multi-variable optimization problems using classical optimization techniques to identify optimal solutions.(L3,L4)

CO3: Formulate and solve transportation problems using the Linear Programming Simplex method to optimize resource allocation. (L3)

CO4: Apply the Linear Programming Simplex method to assignment problems and interpret the results for effective decision-making.(L3)

CO5: Apply gradient-based and non-gradient-based methods for solving constrained and unconstrained nonlinear optimization problems using interior and exterior penalty approaches.(L3,L5)

CO6: Develop and implement Dynamic Programming techniques for optimal solutions in inventory control, production planning, and engineering design problems. (L5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2
CO2	3	3	3	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	2	3	3	2	-	-	-	2	2	1	2
CO5	3	3	3	3	3	-	-	-	2	2	1	2
CO6	3	3	3	3	3	-	-	-	2	2	1	3

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

UNIT I: Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming : Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm.

UNIT III: Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV: Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods.

UNIT V: Dynamic Programming: Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the

tabular method of solution.

Textbooks:

1. "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.

2. "Introductory Operations Research", H.S. Kasene& K.D. Kumar, Springer (India), Pvt.LTd.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.

2. Operations Research, Dr.S.D.Sharma, Kedarnath, Ramnath& Co.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24BS2202	L	T	P	C
		3	0	0	3
PROBABILITY AND STATISTICS					

Course Objectives:

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications Engineering

Course Outcomes: Upon successful completion of this course, the student should be able to

CO1: Classify the concepts of data science and its importance (L2)

CO2: Interpret the association of characteristics and through correlation and regression tools (L4)

CO3: Apply discrete and continuous probability distributions (L3)

CO4: Design the components of a classical hypothesis test (L6)

CO5: Infer the statistical inferential methods based on small and large sampling tests (L4)

CO6: Infer the statistical inferential methods based on large sampling tests (L4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00
CO2	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00
CO3	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00
CO4	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00
CO5	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00
CO6	3.00	2.00	-	-	-	-	-	-	-	-	-	2.00

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

Unit – I: Descriptive statistics and methods for data science:

Data science – Statistics Introduction – Population vs Sample –Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability – Skewness – Kurtosis.

UNIT – II: Correlation and Regression:

Correlation – Correlation coefficient – Rank correlation. Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties – Curvilinear Regression: Parabola – Exponential – Power curves.

UNIT – III: Probability and Distributions:

Probability– Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) – Estimation using t, χ^2 and F-distributions.

UNIT – V: Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference means – Single and two proportions – Student's t- test, F-test, χ^2 -test.

Text Books:

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

Reference Books:

- Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
- Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage. • Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
- Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24ML2201	L	T	P	C
		3	0	0	3
MACHINE LEARNING					

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes:

CO1: Explain the fundamentals of machine learning, its evolution, learning paradigms, and the complete ML pipeline including data preprocessing and model evaluation. (L2)

CO2: Apply nearest neighbor-based classification and regression models using various proximity and distance measures. (L3)

CO3: Construct decision tree models and random forests for classification and regression tasks, and analyze bias–variance trade-offs(L3)

CO4: Analyze Bayes' theorem to build optimal classifiers, and implement Naive Bayes for multi-class classification problems. (L4)

CO5: Develop and compare classification models using linear discriminants, support vector machines, and neural networks such as MLPs with back propagation. (L3)

CO6: Analyze various clustering techniques including K-means, fuzzy clustering, rough clustering, and spectral clustering for unsupervised learning tasks. (L4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	1	1	1	3
CO2	3	3	2	3	3	-	-	-	1	-	-	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2
CO4	3	3	2	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	1	-	2
CO6	3	3	2	3	3	-	-	-	-	-	-	2

	PSO1	PSO2
CO1	-	-
CO2	3	2
CO3	2	2
CO4	3	3
CO5	-	-
CO6	2	-

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 | Class Conditional Independence and 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, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral 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. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

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II Year- II Semester	Course Code: BT24CS2202	L	T	P	C
		3	0	0	3
DATABASE MANAGEMENT SYSTEMS					

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra.
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes

Upon successful completion of this course, the student should be able to

CO1: Determine the basic concept and applications of database system (L3)

CO2: Describe the data models and schemes in Database Management Systems (L3)

CO3: Understand the relational databases system using relational operators in queries (L2)

CO4: Use SQL standard language queries on database (L6)

CO5: Analysis the functional dependencies and design of database (L4)

CO6: Apply the issues of managing the data such as efficiency, privacy, security and ethical responsible (L3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3.00	2.00	-	-	-	-	-	-	-	-
CO3	-	-	2.00	3.00	-	-	-	-	-	-	-	-
CO4	2.00	2.00	2.00	-	3.00	-	-	-	-	-	-	-
CO5	1.00	-	-	-	3.00	-	-	-	-	-	-	-
CO6	2.00	3.00	-	3.00	-	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	-	2.00
CO2	2.00	3.00
CO3	2.00	3.00
CO4	-	3.00
CO5	3.00	-
CO6	-	-

UNIT I: Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, 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, Relational Algebra, Relational Calculus. 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, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, 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, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing:

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, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202 2456_shared/overview

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24EC2208	L	T	P	C
		3	0	0	3
DIGITAL LOGIC & COMPUTER ORGANIZATION					

Course Objectives:

The main objectives of the course is to

- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

Course Outcomes:

At the end of the course students will be able to

CO1: Learn different number systems and basic structure of computer system (L3)

CO2: Demonstrate the arithmetic algorithms (L4)

CO3: Explain the basic concepts of digital components and processor organization (L3)

CO4: Explain the generations of control signals of computer (L3)

CO5: Demonstrate the memory organization (L4)

CO6: Describe the concepts of parallel processing and different buses (L3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	2.00	1.00	-	-	-	-	-	-	-	-	-
CO2	1.00	-	-	2.00	-	-	-	-	-	-	-	-
CO3	1.00	2.00	2.00	-	-	-	-	-	-	-	-	-
CO4	3.00	-	3.00	1.00	-	-	-	-	-	-	-	-
CO5	3.00	2.00	-	3.00	-	-	-	-	-	-	-	-
CO6	3.00	1.00	2.00	2.00	-	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	2
CO6	-	3

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- oper and 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 Multi 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

Textbooks:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M.Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11th Edition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M. Moris Mano, 3rd Edition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Online Learning Resources:

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

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24ML2202	L	T	P	C
		0	0	3	1.5
MACHINE LEARNING LAB					

Course Objectives:

- To learn about computing central tendency measures and Data preprocessing techniques.
- To learn about classification and regression algorithms.
- To apply different clustering algorithms for a problem.

Course Outcomes:

CO1: Apply central tendency and dispersion measures to summarize datasets effectively.(L3)

CO2: Analyze various data pre-processing techniques such as attribute selection, handling missing values, discretization, and outlier elimination to prepare data for machine learning models.(L4)

CO3: Implement classification and regression algorithms like KNN, Decision Tree, and Random Forest for accurate prediction and modeling. (L3)

CO4: Optimize advanced classification techniques such as Naïve Bayes, Support Vector Machine, Logistic Regression, and Multi-layer Perceptron using parameter tuning and performance metrics. (L4)

CO5: Demonstrate and compare regression techniques including Simple Linear Regression and Decision Tree Regression for modeling continuous data(L3,L5)

CO6: Design clustering algorithms such as K-Means, Fuzzy C-Means, and Expectation Maximization, and assess performance using distance measures and parameter variations.(L6)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	1	-	2
CO2	3	3	2	3	3	-	-	-	-	-	-	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	1	-	2
CO5	3	3	3	3	3	-	-	-	-	1	-	2
CO6	3	3	3	3	3	-	-	-	-	-	-	2

	PSO1	PSO2
CO1	-	-
CO2	3	-
CO3	2	2
CO4	-	-
CO5	3	3
CO6	-	-

Software Required: Python/R/Weka

Lab should cover the concepts studied in the course work, sample 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. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. 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.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24CS2205	L	T	P	C
		0	0	3	1.5
DATABASE MANAGEMENT SYSTEMS LAB					

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers.

Course Outcomes:

Upon successful completion of this course, the student should be able to

CO1: Utilize SQL to execute queries for creating database and performing data manipulation operations (L6)

CO2: Apply integrity constraints to build efficient databases (L3)

CO3: Apply Queries using Advanced Concepts of SQL (L3)

CO4: Build PL/SQL programs including stored procedures, functions (L6).

CO5: Build PL/SQL programs cursors and triggers (L6).

CO6: Establish the connection between database using JDBC / ODBC (L6)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2.00	3.00	-	2.00	-	-	-	-	-	-	-	-
CO2	2.00	3.00	3.00	3.00	-	-	-	-	-	-	-	-
CO3	2.00	3.00	3.00	2.00	3.00	-	-	-	-	-	-	-
CO4	2.00	3.00	3.00	3.00	2.00	-	-	-	-	-	-	-
CO5	2.00	3.00	3.00	2.00	2.00	-	-	-	-	-	-	-
CO6	2.00	2.00	3.00	2.00	2.00	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	-	2.00
CO2	-	-
CO3	-	-
CO4	2.00	-
CO5	2.00	-
CO6	-	-

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers.
- Database connectivity- ODBC/JDBC.

Sample 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, RAISEAPPLICATION 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
12. Create a table and perform the search operation on table using indexing and nonindexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

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

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202
DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24CS2206	L	T	P	C
		0	1	2	2
FULL STACK DEVELOPMENT–1(Skill Enhancement Course)					

Course Objectives:

The main objectives of the course are to

1. Make use of HTML element sand their attributes for designing static web pages
2. Build a webpage by applying appropriate CSS styles to HTML elements
3. Experiment with Java Script to develop dynamic web pages and valid ate forms

Course Outcomes:

Upon successful completion of this course, the student should be able to

CO1: Make use of HTML elements (L3)
CO2: Use attributes for designing static web pages (L3).
CO3: Build a web page by applying appropriate CSS styles (L4).
CO4: Build a web page by applying appropriate HTML elements (L4).
CO5: Experiment with JavaScript to develop dynamic web pages (L4).
CO6: Experiment with JavaScript to develop validate forms (L4).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2.00	3.00	-	2.00	-	-	-	-	-	-	-	-
CO2	2.00	3.00	3.00	3.00	-	-	-	-	-	-	-	-
CO3	2.00	3.00	3.00	2.00	3.00	-	-	-	-	-	-	-
CO4	2.00	3.00	3.00	3.00	2.00	-	-	-	-	-	-	-
CO5	2.00	3.00	3.00	2.00	2.00	-	-	-	-	-	-	-
CO6	2.00	2.00	3.00	2.00	2.00	-	-	-	-	-	-	-

	PSO1	PSO2
CO1	-	2.00
CO2	-	-
CO3	-	-
CO4	2.00	-
CO5	2.00	-
CO6	-	-

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables ,Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Select or forms
- CSS with Color, Background ,Font ,Text and CSS Box Model
- Applying JavaScript-internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists ,Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program ,to explain the working of hyperlinks using<a>tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such away that ,rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something liketo100*100pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables.(use tags:<table>,<tr>,<th>, <td>and attributes : border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding ,border, rowspan , colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field ,password field ,number field ,date of birth field ,checkboxes , radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie : submit and reset. Use tables to provide a better view).

- Write a HTML program ,to explain the working of frames, such that page is to be divided into 3 parts on either direction.(Note :first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame "attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of<article>,<aside>,<figure>,<figcaption>, <footer>,<header>,<main>,<nav>,<section>, ,tags.
b. Write a HTML program, to embed audio and video into HTML webpage.
c. Write a program to apply different types (or levels of styles or style specification formats) -inline, internal, external styles to HTML elements.(identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms
    - Simple selector(element, id, class, group, universal)
    - Combinator selector (descendant, child, adjacent sibling, general sibling)
    - Pseudo- class selector
    - Pseudo- element selector
    - Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.
b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
c. Write a program using the following terms related to CSS font and text:

    i. font -size ii. font- weight iii. font- style

    iv. text- decoration v .text- transformation vi. text- alignment
d. Write a program , to explain the importance of CSS Box model using

    i.Content ii. Border iii. Margin iv. padding

6. Applying JavaScript- internal and external, I/O, Type Conversion

a. Write a program to embed internal and external JavaScript in a webpage.
b. Write a program to explain the different ways ford is playing output.
c. Write a program to explain the different ways for taking input.
d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre- defined and User- defined Objects

a. Write a program using document object properties and methods.

b. Write a program using window object properties and methods.

c. Write a program using array object properties and methods.

d. Write a program using math object properties and methods.

e. Write a program using string object properties and methods.

f. Write a program using regex object properties and methods.

g. Write a program using date object properties and methods.

h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".

b. Write a program to display week days using switch case.

c. Write a program to print 1to10 numbers using for, while and do- while loops.

d. Write a program to print data in object using for-in ,for-each and for- of loops

e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]

f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. JavaScript Functions and Events

a. Design a appropriate function should be called to display

- Factorial of that number
- Fibonacci series up to that number
- Prime numbers up to that number
- Is it palindrome or not

b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to

display

1. Factorial of that number
2. Fibonacci series up to that number
3. Prime numbers up to that number
4. Is it palindrome or not

c. Write a program to valid ate the following fields in a registration page

i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)

ii. Mobile(onlynumbersandlength10digits)

iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. Programming the World Wide Web,7th Edition, Robet W Sebesta, Pearson,2013.
2. Web Programming with HTML5,CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, A Press, O'Reilly.

Web Links:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

II Year- II Semester	Course Code: BT24ME2207	L	T	P	C
		1	0	2	2
DESIGN THINKING & INNOVATION					

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and converting to demand.
- Introduce product planning and product development process.

Course Outcomes:

CO1: Apply the concepts related to design thinking in real-world scenarios (L3)

CO2: Analyze the fundamentals of Design Thinking and its role in innovation (L4)

CO3: Develop design thinking techniques to solve complex problems across various industries (L5)

CO4: Assess the effectiveness of working in a multidisciplinary environment for product innovation (L5)

CO5: Evaluate the impact of creativity and innovation on business and product development (L6)

CO6: Create innovative solutions by integrating design thinking into business processes and entrepreneurship (L6).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00
CO2	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00
CO3	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00
CO4	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00
CO5	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00
CO6	3.00	-	2.00	2.00	-	2.00	-	2.00	3.00	2.00	-	2.00

	PSO1	PSO2
CO1	3.00	-
CO2	3.00	-
CO3	3.00	-
CO4	3.00	-
CO5	3.00	-
CO6	3.00	-

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 modeling, 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 Start ups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for start up.

Textbooks:

1. Tim Brown, Change bydesign,1/e, Harper Bollins,2009.
2. Idris Mootee, Design Thinking for Strategic Innovation,1/e, Adams Media,2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulyssespress,2018.
2. Shrrutin N Shetty,Design the Future,1/e,Norton Press,2018.
3. Willia mlid well, Kritina holden, & Jill butter, Universal principlesofdesign,2/e, Rockport Publishers, 2010.
4. Chess brough. H, Theera of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview