M. TECH. TWO YEAR DEGREE

PROGRAM CURRICULUM

(Applicable for the batches admitted from A.Y 2026-27)

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

ADITYA UNIVERSITY

Aditya Nagar, ADB Road, Surampalem - 533 437

VISION & MISSION OF THE UNIVERSITY

VISION:

To be a globally recognized university through excellence in Education, Innovation and Sustainable growth.

MISSION:

Deliver collaborative education to prepare students for global challenges through

- Transformative learning
- Vibrant research ecosystem
- Sustainable and inclusive community

VISION & MISSION OF THE DEPARTMENT

VISION

To be a center of excellence in Data Science through innovative education and impactful research, fostering global recognition and sustainability.

MISSION

M1: Equip students with advanced Data Science knowledge and skills to solve industrial and societal challenges.
M2: Foster research and innovation through interdisciplinary collaboration in emerging technologies.
M3: Collaborate with industry and community to develop inclusive, sustainable data-driven solutions.

PROGRAM OUTCOMES (POs)
After successful completion of the program, the graduates will be able to

PO 1	Independently carry out research /investigation and development work to solve practical problems
PO 2	Write and present a substantial technical report/document
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
PO 4	Learn; keep up with contemporary technologies and ways of working.
PO 5	Communicate effectively as an individual or a team leader in diverse and multidisciplinary groups.
PO 6	Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of finance for profitable project management.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After successful completion of the program, the graduates will be able to

PEO 1	Apply advanced data science and AI techniques to solve complex industrial and societal problems.
PEO 2	Engage in interdisciplinary research, innovation, and lifelong learning
PEO 3	Demonstrate professional ethics, leadership, and effective collaboration with industry and academia.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the Program will be able to

PSO 1	Develop innovative solutions to complex problems using advanced data science techniques.
PSO 2	Design adaptive predictive models and conduct research in emerging areas of data science.

ADITYA UNIVERSITY

Department of Data Science

Master of Technology in AI&DS

Program Curriculum 2026

Credit Division

S.No	Category of Course	Credits
1	Program Core Courses (PCC)	33
2	Program Elective Courses (PEC)	15
3	Technical Seminar (TS)	02
4	Technical Paper Publication (TPP)	02
5	Project – Part I & II (PROJ)	28
6	Audit Course (AUC)	0
Total Credits		80

Program Core Courses (PCC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502DS01	Mathematics for Data Science	3	0	0	3	50	50	100	-
2502DS02	Introduction to Artificial Intelligence	2	0	1	3	50	50	100	-
2502DS03	Advanced Data Structures and Algorithms	2	0	1	3	50	50	100	-
2502DS04	Introduction to Data Science	1	0	2	3	50	50	100	-
2502DS05	Data Visualization	2	0	1	3	50	50	100	
2502AI05	Machine Learning Algorithms	2	0	1	3	50	50	100	IAI
2502DS06	Introduction to Deep Learning	2	0	1	3	50	50	100	-
2502AI06	Big Data Analytics	3	0	0	3	50	50	100	-
2502DS07	Artificial Neural Networks	2	0	1	3	50	50	100	-
2502DS08	Information Retrieval Systems	1	0	2	3	50	50	100	-
2502AI15	Natural Language Processing	2	0	1	3	50	50	100	MLA
Total		22		11	33				

Program Elective Courses (PEC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502CS11	Artificial Cognitive Systems	2	0	1	3	50	50	100	IAI
2502DS09	Cyber Security	2	0	1	3	50	50	100	-
2502AI21	Advanced Data Mining	2	0	1	3	50	50	100	-
2502DS10	Intelligent Systems	2	0	1	3	50	50	100	MLA
2502DS11	Data Preparation and Analytics	2	0	1	3	50	50	100	-
2502CS21	Block Chain Technology	2	0	1	3	50	50	100	CS
2502DS12	Computer Vision Techniques	2	0	1	3	50	50	100	MLA
2502DS13	Fuzzy Logic and Fuzzy Sets	2	0	1	3	50	50	100	IAI
2502AI19	Recommender Systems	2	0	1	3	50	50	100	DL
2502CS17	AI for Language and Text Processing	2	0	1	3	50	50	100	NLP
2502AI26	Reinforcement Learning	2	0	1	3	50	50	100	MLA
2502CS12	Internet of Things	2	0	1	3	50	50	100	-
2502DS14	Health Care Data Analytics	2	0	1	3	50	50	100	-
2502CS23	Quantum Computational Methods	2	0	1	3	50	50	100	-
2502AI20	Time Series Analysis	2	0	1	3	50	50	100	MLA

Technical Seminar (TS)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502CS25	Technical Seminar			2	2	100	-	100	-

Technical Paper Publication (TPP)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502CS29	Technical Paper Publication			2	2	100	-	100	-

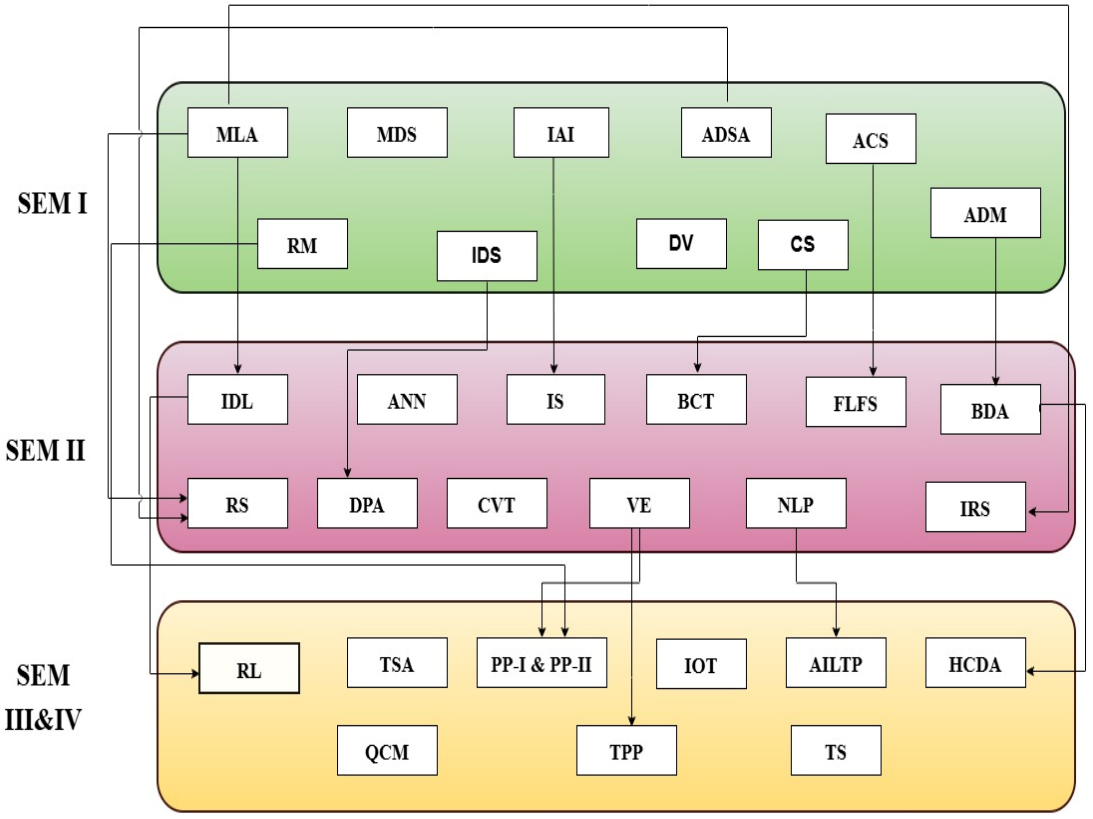
Project –Part I & II (PROJ)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502CS30	Project Part I			10	10	100	-	100	-
2502CS31	Project Part II			18	18	50	50	100	

Audit Courses (AUC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
2502CE33	Research Methodology	2			0	100	-	100	-
2502CE32	Value Education	2			0	100	-	100	-

2026 M.Tech AI&DS Curriculum Prerequisite Flowchart



List of Courses	
MDS	Mathematics for Data Science
IAI	Introduction to Artificial Intelligence
ADSA	Advanced Data Structures and Algorithms
ACS	Artificial Cognitive Systems
CS	Cyber Security
ADM	Advanced Data Mining
IS	Intelligent Systems
DPA	Data Preparation and Analytics
BCT	Block Chain Technology
IDS	Introduction to Data Science
DV	Data Visualization
MLA	Machine Learning Algorithms
IDL	Introduction to Deep Learning
BDA	Big Data Analytics
ANN	Artificial Neural Networks
CVT	Computer Vision Techniques
FLFS	Fuzzy Logic and Fuzzy Sets
RS	Recommender Systems
AILTP	AI for Language and Text Processing
RL	Reinforcement Learning
IoT	Internet of Things
IRS	Information Retrieval Systems
NLP	Natural Language Processing
HCDA	Health Care Data Analytics
QCM	Quantum Computational Methods
TSA	Time Series Analysis
TS	Technical Seminar
TPP	Technical Paper Publication
PP-I & PP-II	Project – Part I & II
RM	Research Methodology
VE	Value Education

Suggestive Semester wise Curriculum

I Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
2502DS01	Mathematics for Data Science	PCC	3	0	0	3	3
2502DS02	Introduction to Artificial Intelligence	PCC	2	0	1	3	4
2502DS03	Advanced Data Structures and Algorithms	PCC	2	0	1	3	4
	Professional Elective Course I	PEC	2	0	1	3	4
2502DS04	Introduction to Data Science	PCC	1	0	2	3	5
2502DS05	Data Visualization	PCC	2	0	1	3	4
2502AI05	Machine Learning Algorithms	PCC	2	0	1	3	4
2502CE33	Research Methodology	AUC	2	0	0	0	2
Total			**16**	**0**	**7**	**21**	**30**

II Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
2502DS06	Introduction to Deep Learning	PCC	2	0	1	3	4
2502AI06	Big Data Analytics	PCC	3	0	0	3	3
2502DS07	Artificial Neural Networks	PCC	2	0	1	3	4
	Professional Elective Course II	PEC	2	0	1	3	4
	Professional Elective Course III	PEC	2	0	1	3	4
2502DS08	Information Retrieval Systems	PCC	1	0	2	3	5
2502AI15	Natural Language Processing	PCC	2	0	1	3	4
2502CE32	Value Education	AUC	2	0	0	0	2
Total			**16**	**0**	**7**	**21**	**30**

III Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
	Professional Elective Course IV	PEC	2	0	1	3	4
	Professional Elective Course V	PEC	2	0	1	3	4
2502CS25	Technical Seminar	TS			2	2	-
2502CS30	Project Part -I	PROJ			10	10	20
Total			**4**	**0**	**14**	**18**	**28**

IV Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
2502CS29	Technical Paper Publication	TPP				02	-
2502CS31	Project Part-II	PROJ			18	18	36
Total					**18**	**20**	**36**

S.No	Course Code	Course Name
Professional Elective -I (I Semester)		
1	2502CS11	Artificial Cognitive Systems
2	2502DS09	Cyber Security
3	2502AI21	Advanced Data Mining
Professional Elective -II (II Semester)		
1	2502DS10	Intelligent Systems
2	2502DS11	Data Preparation and Analytics
3	2502CS21	Block Chain Technology
Professional Elective -III (II Semester)		
1	2502DS12	Computer Vision Techniques
2	2502DS13	Fuzzy Logic and Fuzzy Sets
3	2502AI19	Recommender Systems
Professional Elective -IV (III Semester)		
1	2502CS17	AI for Language and Text Processing
2	2502AI26	Reinforcement Learning
3	2502CS12	Internet of Things
Professional Elective -V (III Semester)		
1	2502DS14	Health Care Data Analytics
2	2502CS23	Quantum Computational Methods
3	2502AI20	Time Series Analysis

MATHEMATICS FOR DATA SCIENCE

Course Code: 2502DS01

L	T	P	C
3	0	0	3

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

CO1: Apply discrete mathematics concepts including set theory, logic, recurrence relations, combinatorics and probability.

CO2: Apply calculus and vector analysis techniques to solve multivariable problems.

CO3: Use matrix algebra and eigen concepts in solving linear systems.

CO4: Use matrix algebra and eigen concepts in solving linear systems.

CO5: Analyse linear transformations using kernel, image and rank-nullity theorem.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	2	2	1	1
CO3	3	3	2	2	1	1
CO4	3	2	2	1	1	1
CO5	3	3	2	2	1	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	2	2
CO5	3	2

UNIT – I

Set Theory: Binary Operations, Functions and Relations, Recurrence Relations and Generating Functions, Permutations and Combinations, Pigeon Hole Principle, Probability Theory, Propositional Calculus, Tautology & Contradiction.

UNIT – II

Differentiation: Logarithmic Differentiation, Partial Differentiation, Euler's Theorem for Homogeneous Functions, Maxima and Minima. Integration: Double Integration, Change/Order of Integration. Vectors: Dot Product, Cross Product, Divergence and Convergence of a Vector.

UNIT – III

Matrices & Determinants: Matrix Definition and Types, Matrix Addition and Subtraction, Matrix Multiplication, Singular and Non-Singular Matrices, Matrix Rank, Solution of Simultaneous Equations, Cayley–Hamilton Theorem, Eigenvalues and Eigenvectors, Diagonalisation of a Matrix.

UNIT – IV

Matrix Algebra and Linear Algebra: Introduction of Groups, Rings and Vector Spaces. Linear Independence and Dependence of Vectors, Linear Combination, Basis and Dimension of Vector Space, Sub-Space, Intersection and Union of Subspaces.

UNIT – V

Linear Transformation: Matrices as Linear Mapping, Kernel and Image. Statement of Rank–Nullity Theorem, Singular and Non-Regular Linear Mappings.

Textbooks:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill. ISBN: 978-0074631133.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. ISBN: 978-0470458365.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5th Edition (9th Reprint), Alpha Science International Ltd. ISBN: 978-8184875607
4. B. V. Ramana, Higher Engineering Mathematics, 11th Edition, McGraw-Hill Education. ISBN: 978-9339216016

Reference Books:

1. Discrete Mathematics and Its Applications with Combinatorics and Graph Theory – Kenneth H. Rosen, McGraw-Hill Education (India) Private Limited. ISBN: 9780070681880.
2. Advanced Engineering Mathematics – Michael Greenberg,9th Edition, Pearson Publishers. ISBN-13: 9788177585469.
3. Linear Algebra and Its Applications – David C. Lay,5th Edition, Pearson Education.ISBN: 9780321982384.

Weblinks:

1. https://archive.nptel.ac.in/courses/111/104/111104137/
2. https://archive.nptel.ac.in/courses/111/107/111107108/
3. https://www.classcentral.com/course/differential-equations-engineers-13258
4. http://nptel.ac.in/courses/106106094/
5. http://mathworld.wolfram.com/classroom/classes/DiscreteMathematics.html

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Code: 2502DS02

L	T	P	C
2	0	1	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1 Learn the differences between optimal reasoning and human-like reasoning in AI systems.

CO2 Evaluate basic principles of AI for problem solving, inference, perception, knowledge representation, and learning.

CO3 Apply state space representation and heuristic search techniques to analyze time and space complexities.

CO4 Identify AI applications such as Intelligent Agents, Game Playing, Expert Systems, Machine Learning, and Natural Language Processing.

CO5 Analyze Robotics concepts including robot architectures, sensors, effectors, configuration spaces, navigation, motion planning, and AI-based robotic programming tools.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	2	1	
CO2	3	2	3	2	1	
CO3	3	1	3	2		
CO4	2	2	3	3	2	
CO5	3	2	3	3	1	2

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	3	2
CO4	2	2
CO5	3	2

UNIT – I

Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, the nature of the Environment, Problem solving Agents, Problem Formulation and State Space Representation, Search Techniques in AI, Search Strategies

Practice:

1. Represent all possible game states of Tic-Tac-Toe and implement a basic move selection.
2. Solve the 8-puzzle problem using BFS or A*. Take an initial puzzle configuration as input and display the sequence of moves required to reach the goal state. Also, show the puzzle state at each step.

UNIT – II

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining, Ontologies and Semantic Knowledge Representation, Reasoning under Uncertainty.

Practice:

1. Implement a simple knowledge-based agent that makes decisions using facts stored in its knowledge base.
2. Represent relationships and objects using first-order logic.

UNIT – III

Learning: Learning from Observations, Forms of Learning, Overfitting and Underfitting, Inductive Learning, Model Evaluation and Performance Metrics, Learning Decision Trees, Learning Works, Learning in Neural and Belief networks, Auto encoders and Representation Learning, Ethical Issues

Practice:

1. Train a polynomial regression model on a dataset and demonstrate overfitting and underfitting.
2. Build a decision tree classifier on a dataset (e.g., Iris or Titanic) and visualize the tree.
3. Implement a simple feedforward neural network to classify a dataset

UNIT – IV

Practical Natural Language Processing: Practical applications, Efficient parsing, scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Transformer Models, Multimodal AI (Text, Image, Speech Integration), Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

Practice:

1. 1.Implement text preprocessing including tokenization, stop word removal, and stemming/lemmatization.
2. Implement a simple model that takes text and image as input and predicts a label.

UNIT – V

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Human-Robot Interaction, Simultaneous Localization and

Mapping (SLAM), Reinforcement Learning for Robotics,AI based programming Tools, Ethical and Safety Issues in Robotics

Practice:

1. Simulate a robot with sensors that can detect obstacles and stop or avoid them.
2. Implement a robot path planning algorithm in a 2D environment avoiding obstacles.
3. Implement a simple interface where the robot responds to human commands.

Additional Practice:

1. Implement a simple maze-solving agent using DFS and BFS, and compare the paths generated.
2. Build a small knowledge base using first-order logic to represent family relationships and infer new relations

Text Books:

1. Artificial Intelligence and Machine Learning, 2nd Edition, Rajesh K. Shukla, McGraw Hill.
2. Deep Learning, 1st Edition, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press.
3. Simon Prince, Understanding Deep Learning.
4. Dive into Deep Learning by Zhang, Lipton, Zi, and Smola
5. Neural Networks and Deep Learning , Charu C Aggarwal

Reference Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, 2nd Edition, Pearson Education.
2. Natural Language Processing with Java, 2nd Edition, Richard M. Reese, O’Reilly Media.
3. E. Rich and K. Knight, “Artificial Intelligence”, 3rd Edition, TMH.
4. Dan W. Patterson, “Artificial Intelligence and Expert Systems”, PHI.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc25_cs159/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs57/preview

ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: 2502DS03

L	T	P	C
2	0	1	3

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

CO1: Demonstrate dictionary operations and hashing techniques and apply them to solve real-world problems efficiently
CO2: Explain randomized skip lists and analyse search efficiency
CO3: Implement string matching algorithms and tree-based text structures.
CO4: Implement heap-based priority queues and binary search tree operations.
CO5: Design and implement variety of data structures including binary trees, heaps, graphs and search trees

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1	2		
CO2	1		1	2		
CO3	1	2	1	2		
CO4	1		1	2		
CO5	1	1	1	1	1	2

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3		1
CO4	1	
CO5	1	1

UNIT – I

Dictionaries: Definition, Dictionary, Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Practice:

1. Write a Java program to implement Dictionary ADT
2. Write a Java program to implement a Hash Function

UNIT – II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

Practice:

1. Write a Java program to implement a basic Skip List
2. Write a Java program to perform Skip List operations: insert, search, delete, and display

UNIT – III

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Trees, Compressed Trees, Suffix Trees, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

Practice:

1. Write a java program for Brute-Force pattern matching to find all occurrences of a pattern in text
2. Write a java program to Implement Huffman coding algorithm to encode characters based on frequency.

UNIT – IV

Priority Queues: Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion, Deletion, Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations- Searching, Insertion, Deletion

Practice:

1. Write a Java program to implement a Priority Queue using Max Heap.
2. Write a Java program to implement a BST.

UNIT – V

Trees and Graphs: AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees, Graphs terminology, Graph ADT, representations, graph traversals/search methods DFS and BFS, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem

Practice:

1. Write a Java program to implement AVL tree insertion.
2. Write a Java program to implement Breadth First Search algorithm

Additional Practice:

1. Write a Java program to find Minimum Cost Spanning Tree using Kruskal's algorithm.
2. Write a Java program to find Single Source Shortest Path using Dijkstra's algorithm.

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson.

2. Sartaj Sahni, “Data Structures, Algorithms and Applications in Java”, 2nd Edition, Universities Press.
3. M T Goodrich, Roberto Tamassia, “Data Structures and Algorithms in Java”, 6th Edition, Wiley.

Reference Books:

1. M T Goodrich, Roberto Tamassia, “Algorithm Design”, John Wiley.
2. Data Structures and Algorithms in Java, Adam Drozdek, 3/e, Cengage, ISBN: 978- 8131506554.

Web Links:

1. https://nptel.ac.in/courses/106102064/
2. https://www.coursera.org/learn/advanced-data-structures-in-java

INTRODUCTION TO DATA SCIENCE

Course Code: 2502DS04

L	T	P	C
1	0	2	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Make use of NumPydata manipulation and processing.

CO2: Apply pandas to effectively manage data loading and storage across multiple file formats.

CO3: Describe the importance ofpre-processing techniques

CO4: Evaluate machine learning models using appropriate metrics

CO5: Apply Data Visualization for plotting of datasets.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	1	-
CO2	2	2	2	1	1	-
CO3	2	2	2	1	1	-
CO4	2	2	2	1	1	-
CO5	2	2	2	1	1	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	2
CO2	1	2
CO3	1	2
CO4	1	2
CO5	1	2

UNIT – I

Introduction to Data Science: Need for Data Science – What is Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required.

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays, Sorting, Unique.

Practice:

Creating a NumPy Array

1. Basic ndarray, Array Shape.
2. Array of zeros, Array Slicing.
3. Array of ones, Sorting, Searching.
4. Random numbers in ndarray, Array Join.

UNIT – II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality Reindexing, dropping entries from an axis, Indexing, selection, and filtering), Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

Practice:

Perform following operations using pandas

1. Creating dataframe, Dataseries.
2. concat(), Grouping, Joining and merging.
3. Setting conditions
4. Adding a new column, Detect missing values.

UNIT – III

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

Practice:

Perform following visualizations using matplotlib

1. Bar Plot
2. Pie Chart
3. Box Plot
4. Histogram Plot

UNIT – IV

Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in Mongo DB.

Practice:

Read the following file formats using pandas

1. Text files
2. CSV files
3. Excel files
4. JSON files

UNIT – V

Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values. **Machine Learning Fundamentals:** Supervised Learning: Regression and Classification, Unsupervised Learning: Clustering and Dimensionality Reduction, Evaluation Metrics for Machine Learning, Overfitting and Underfitting, Model Selection and Hyperparameter Tuning

Practice:

Perform following operations using pandas

1. Creating dataframe, Filtering data
2. Data replace, Remove duplication.
3. Setting conditions, merge operation.
4. Adding a new column, grouping method.

Text Books:

1. Python for Data Analysis", Wes McKinney, 2nd edition. O'REILLY, ISBN-13: 978- 1491957660,
2. Doing Data Science, Rachel Schutt & Cathy O'neil, 1st edition O'REILLY, ISBN-10: 1449358659 ISBN-13: 978-1449358655

Reference Books:

1. Data Science from Scratch: First Principles with Python, Joel Grus, 2nd edition. O'Reilly
2. Media ISBN-13: 978-1492041139 ISBN-10: 1492041130.
3. Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, Matt Harrison, O'Reilly ISBN: 9781533598240.
4. Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas Müller and Sarah Guido ISBN: 9352134575.

Web Links:

1. https://en.m.wikipedia.org/wiki/Data_Science_and_Predictive_Analytics/
2. https://nptel.ac.in/courses/106106179/

DATA VISUALIZATION

Course Code: 2502DS05

L	T	P	C
2	0	1	3

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

CO1: Understand fundamental concepts, principles, and best practices of data visualization including visual perception and graphical encoding.
CO2: Analyze data visualization problems and select appropriate visualization techniques based on context and audience.
CO3: Design effective dashboards by applying usability principles, visual perception theories, and storytelling techniques.
CO4: Develop interactive and static data visualizations using Tableau for analytical and explanatory purposes.
CO5: Implement data visualization solutions using Python libraries such as Matplotlib, Seaborn, and Bokeh for real-world datasets.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	-
CO2	-	3	2	-	-	-
CO3	-	-	3	2	-	-
CO4	-	-	3	2	1	-
CO5	-	-	3	2	2	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	3	-
CO2	2	2
CO3	2	2
CO4	-	3
CO5	-	3

UNIT-I

Data Visualizations and Practices: Context and importance of data visualization in the digital age – Visualization as a discovery and communication tool – Exploratory and explanatory analysis – Selecting appropriate visual forms – Avoiding clutter and improving clarity – Introduction to visual cues and pre-attentive attributes – Overview of commonly used visualization techniques.

Practice:

1. Identify exploratory and explanatory visualizations from given examples.
2. Select suitable chart types for simple datasets.
3. Detect clutter in visualizations and suggest basic improvements.

UNIT-II

Data Visualization with Tableau: Basics of visual analytics – Overview of Tableau Desktop environment – Connecting to data sources – Understanding dimensions and measures – Creating basic visualizations – Applying filters and simple calculations – Introduction to geographic visualization using maps.

Practice:

1. Connect Tableau to a sample dataset.
2. Create basic charts such as bar, line, and pie charts.
3. Apply filters and sorting to improve analysis.

UNIT-III

Effective Dashboard Design: Dashboard concept and objectives – Types of dashboards and their applications – Typical dashboard data – Common dashboard design mistakes – Basic principles of layout and usability – Characteristics of an effective dashboard – Introduction to storytelling using dashboards.

Practice:

1. Identify suitable dashboard types for given scenarios.
2. List common design mistakes observed in sample dashboards.
3. Design a simple and clear dashboard layout.

UNIT – IV

Data Visualization with Python – Matplotlib: Overview of Python-based data visualization – Introduction to Matplotlib – Basic plot types: line, bar, scatter – Simple styling, labelling, and annotations – Plotting data from CSV files – Visualizing real-world datasets.

Practice:

1. Create line and bar charts using Matplotlib.
2. Add titles, labels, and legends to plots.
3. Plot data from a CSV file.

UNIT-V

Data Visualization with Python – Seaborn & Bokeh: Need for advanced and interactive visualization – Overview of Seaborn for statistical visualization – Distribution and categorical plots – Introduction to Bokeh – Basics of interactive and dynamic visualizations.

Practice:

1. Create simple statistical plots using Seaborn.
2. Visualize data distributions using histograms.
3. Create categorical plots using Seaborn.

Additional Practice:

1. Convert tabular data into appropriate visualizations.
2. Compare the same dataset using Tableau and Python tools.
3. Improve a poorly designed visualization based on learned principles.
4. Mini visualization assignment using a real-world dataset.

Text Books:

1 Data Visualisation: A Successful Design Process, Andy Kirk – Pearson Education, 1st Edition.
2 Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic – Wiley, 1st Edition.

Reference Books:

1 Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few – Wiley, 2nd Edition.
2 Matplotlib for Python Developers: Effective Techniques for Data Visualization with Python, Aldrin Yim, Claire Chung, Allen Yu – Packt Publishing, 1st Edition.
3 Fundamentals of Data Visualization, Claus O. Wilke – O'Reilly Media, 1st Edition.
4 The Functional Art: An Introduction to Information Graphics and Visualization, Alberto Cairo – New Riders, 1st Edition.

Web Links:

1 https://help.tableau.com
2 https://matplotlib.org

MACHINE LEARNING ALGORITHMS

Course Code: 2502AI05

L	T	P	C
2	0	1	3

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

CO1: Outline the Concepts of Machine Learning and Statistical Learning
CO2: Build Regression and Classification models for given data.
CO3: Make use of ensemble learning techniques to improve the performance of a model
CO4: Apply clustering techniques on high dimensional data to group the similar entities
CO5: Implement neural network models using keras and tensor flow libraries

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	-	-	-
CO2	2	2	3	-	-	-
CO3	2	2	3	-	1	-
CO4	2	2	3	-	-	-
CO5	2	2	2	-	2	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	-
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT – I

Introduction- Artificial Intelligence, Machine Learning, Deep Learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

Practice:

1. Simulate Empirical Risk Minimization (ERM) on a simple dataset by minimizing squared error for a linear function.
2. Compare training and test loss on a dataset (e.g., Boston Housing) to demonstrate overfitting and underfitting with plots

UNIT – II

Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression,

Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.

Practice:

1. Implement and compare Decision Tree, K-Nearest Neighbors, and Logistic Regression classifiers on the Iris dataset.
2. Apply Support Vector Machine (SVM) on the MNIST dataset and evaluate its performance using confusion matrix and accuracy.

UNIT – III

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

Practice:

1. Train Bagging, Random Forest, and Gradient Boosting models on a classification dataset and compare their performance metrics.
2. Implement a Voting Classifier combining SVM, Naive Bayes, and Logistic Regression and test it on a binary classification dataset.

UNIT – IV

Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.

Practice:

1. Perform clustering on image data (e.g., digits) using K-Means and visualize clusters using PCA for dimensionality reduction.
2. Use DBSCAN and Gaussian Mixture Models on a synthetic 2D dataset and compare their clustering behavior visually.

UNIT – V

Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.

Practice:

1. Build and train a simple Multi-Layer Perceptron (MLP) using Keras on the Fashion MNIST dataset.
2. Use TensorFlow to load a custom dataset (CSV or image), preprocess it, and feed it into a neural network for classification.

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications.
2. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November.

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly

Web Links:

1. https://www.deeplearning.ai/machine-learningyearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html
3. https://onlinecourses.nptel.ac.in/noc21_cs24/preview
4. https://www.udemy.com/course/machinelearning/

INTRODUCTION TO DEEP LEARNING

Course Code: 2502DS06

L	T	P	C
2	0	1	3

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

CO1: Demonstrate the mathematical foundations of neural networks and deep learning models.
CO2: Analyze machine learning and deep learning algorithms for effective data analysis.
CO3: Analyze challenges and optimization strategies in deep neural networks.
CO4: Design and implement deep feedforward and convolutional neural network models.
CO5: Build and train sequence models using RNNs and LSTMs.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	-	2	1	-	2	-
CO2	-	2	1	-	2	-
CO3	-	2	-	3	1	-
CO4	2	2	3	-	1	-
CO5	1	2	3	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

UNIT-I

Introduction to Deep Learning: Definition, Applications, Neural Networks, Machine Learning vs Deep Learning, Deep Learning Libraries (Tensorflow, Keras, PyTorch), Types (Supervised Learning, Unsupervised Learning, Reinforcement Learning) and their Comparison. Datasets: Numerical Data, Categorical Data, Data Quality, Data Remediation, Data Preprocessing (Dimensionality Reduction, Feature Transformation, Feature Subset Selection).

Practice:

1. Load a numerical and categorical dataset and perform data preprocessing (handling missing values, encoding, normalization).
2. Implement feature selection and dimensionality reduction (PCA) on a given dataset.

3. Compare Machine Learning vs Deep Learning using a simple ML model and a neural network on the same dataset.

UNIT-II

Neural Networks: Basics, Types, Intuitions, Neurons, Kernels, Biases, Weights, Initialization, Gradient Descent, Heuristics, Training (Holdout Method, K-Fold Cross-Validation Method, Bootstrap Sampling, Lazy vs Eager Learner), Evaluation (Regression, Classification and Clustering), Perceptrons, Derivatives, Computation graph, Vectorization, Broadcasting, Propagation (Forward and Back), Parameters vs Hyperparameters.

Practice:

1. Implement a single-layer perceptron for binary classification.
2. Write a program to demonstrate forward propagation and backpropagation.
3. Train a neural network using gradient descent and observe loss convergence.

UNIT-III

Deep Feedforward Network: Feed-forward Networks, Gradient-based Learning, Hidden Units, Architecture Design, Computational Graphs, Back- Propagation, Regularization, Parameter Penalties, Data Augmentation, Multi-task Learning, Bagging, Dropout and Adversarial Training and Optimization.

Practice:

1. Apply **dropout** and compare performance with and without dropout.
2. Perform **hyperparameter tuning** (learning rate, batch size, epochs) and analyze

UNIT – IV

Convolution Networks: Convolution Operation, Pooling, Basic Convolution Function, Convolution Algorithm, Unsupervised Features and Neuroscientific for convolution Network.
Sequence Modelling: Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder Decoder Sequence-to-Sequence Architectures, Deep Recurrent Network, Recursive Neural Networks and Echo State networks.

Practice:

1. Implement an RNN model for sequence prediction (text or time series).
2. Build and train an LSTM model and compare it with a simple RNN.

UNIT – V

Adversarial Learning: Unifying Variational Autoencoders and Generative Adversarial Networks - Adversarial Autoencoders - Evaluation of Generative Models.
Deep Generative Models: Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Sigmoid Belief Networks, Directed Generative Net, Drawing Samples from Auto -encoders.

Practice:

1. Implement a basic Autoencoder for dimensionality reduction.
2. Build a Generative Adversarial Network (GAN) for image generation.

Text Books:

1. Goodfellow L., Bengio Y. and Courville A., "Deep Learning", MIT Press.
2. Patterson J. and Gibson A., "Deep Learning: A Practitioner's Approach", O'Reilly 1st Edition.

Reference Books:

1. Haykin S., "Neural Network and Machine Learning", Prentice Hall Pearson 3rd Edition.
2. Geron A., "Hands-on Machine Learning with Sci-kit and TensorFlow", O'Reilly Media.

Web Links:

1. https://www.deeplearning.ai
2. https://pytorch.org/tutorials/
3. https://www.tensorflow.org/tutorials
4. https://cs231n.stanford.edu

BIG DATA ANALYTICS

	L	T	P	C
Course Code: 2502AI06	3	0	0	3

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

CO1: Illustrate big data challenges in different domains.
CO2: Use various techniques for mining data stream.
CO3: Demonstrate Building blocks of Hadoop.
CO4: Choose map reduce approach to solve big data Problems.
CO5: Make use of Pig and Hive to structure and work with big Data.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	1	2	-
CO2	2	3	-	1	2	-
CO3	2	1	-	3	2	-
CO4	3	2	-	2	2	-
CO5	2	3	-	2	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT – I

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT – II

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications.

UNIT – III

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce

Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT – IV

Pig: Hadoop Programming Made Easier: Admiring the Pig Architecture, Going with the Pig Latin Application Flow, working through the ABCs of Pig Latin, Checking out the Pig Script Interfaces, Scripting with Pig Latin. Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works with examples, Querying and Analyzing Data.

UNIT – V

Spark: Installing Spark, Spark applications, Jobs, stages and Tasks, Resilient Distributed data sets, Shared Variables, Anatomy of a Spark job run

Text Books:

1 Hadoop: The Definitive Guide, Tom White, 4 th Edition, O'reilly.

2 Hadoop for Dummies, Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, BruceBrown, RafaelCoss, John Wiley & Sons.

3 Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP.

Reference Books:

1 Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons.

2 Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data:The IBM Big Data Platform", Tata McGraw Hill Publications.

3 Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT.

4 Learning Spark: Lightning Fast Big Data Analysis Paperback, Holden Karau

Web Links:

1 Hadoop: http://hadoop.apache.org/

2 Hive: https://cwiki.apache.org/confluence/display/Hive/Home

3 http://nptel.ac.in/courses/106106142/

4 https://hortonworks.com/tutorial/how-to-process-data-with-apache-hive/

5 https://databricks.com/spark/getting-started-with-apache-spark

ARTIFICIAL NEURAL NETWORKS

Course Code: 2502DS07

L	T	P	C
2	0	1	3

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

CO1: Explain fundamentals of artificial neurons, activation functions, and basic neural network architectures.
CO2: Implement supervised learning models using perceptron, delta rule, and back propagation algorithms.
CO3: Develop unsupervised learning networks for clustering and pattern classification.
CO4: Design advanced unsupervised models such as counter propagation and ART networks.
CO5: Implement associative memory networks for pattern storage and retrieval.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	3	-	-
CO2	3	2	3	2	1	-
CO3	3	2	3	2	1	-
CO4	3	2	3	2	1	-
CO5	2	2	3	1	1	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	3	3
CO5	3	2

UNIT – I

Introduction: History of Neural Networks, Structure and Functions of Biological and Artificial Neuron, Activation functions used in ANNs, Characteristics of ANN, Typical classes of network architectures.

Practice:
1. Implementation of an Artificial Neuron Using Activation Functions
2. Implementation of a Feed forward Neural Network Architecture

UNIT – II

Supervised Learning: Single Layer Neural Network and architecture, Learning Rules, Perceptron Model, Perceptron Convergence Theorem, Delta learning rule, Multi-Layer

Neural Network and architecture, Feed forward ANN, Back Propagation Algorithm, Practical and design issues of Back Propagation learning.

Practice:

1. Implementation of a single-layer perceptron using supervised learning rules.
2. Implementation of a multi-layer feedforward neural network using backpropagation

UNIT – III

Unsupervised Learning-1: Outstar Learning, Kohenen Self Organization Networks, Hamming Network and MAXNET, Learning Vector Quantization, Mexican hat.

Practice:

1. Implementation of Kohonen Self-Organizing Map (SOM) / Outstar learning network.
2. Implementation of Hamming Network and MAXNET for pattern classification.

UNIT – IV

Unsupervised Learning-2: Counter Propagation Network -Full Counter Propagation network, Forward Only Counter Propagation Network, Adaptive Resonance Theory (ART) - Architecture, Algorithms.

Practice:

1. Implementation of Counter Propagation Network (Full / Forward-Only CPN).
2. Implementation of Adaptive Resonance Theory (ART) neural network.

UNIT – V

Associative Memory Networks: Introduction, Auto Associative Memory, Hetero Associative Memory, Bidirectional Associative Memory (BAM) -Theory and Architecture, BAM Training Algorithm, Hopfield Network: Introduction, Architecture of Hopfield Network.

Practice:

1. Implementation of Auto and Hetero Associative Memory models.
2. Implementation of BAM and Hopfield Network for pattern retrieval.

Additional Practice:

1. Implementation of Single Layer Neural Network using learning rules for weight updation.
2. Implementation of Forward Only Counter Propagation Network for input–output mapping.
3. Implementation of Learning Vector Quantization (LVQ) network for supervised pattern classification.

Text Books:

1. Neural Networks: A Comprehensive Foundation, Simon Haykin, Second Edition, Pearson Education (US), ISBN-10:0138958637.
2. Artificial Neural Networks, B. Yegnanarayana, PHI, ISBN-10:8120312538.

Reference Books:

1. Introduction to Artificial Neural Systems, Jacek M. Zurada, Jaico Publishing House, First Edition, ISBN-10:8172246501.
2. 2. Neural Networks: Algorithms, Applications and Programming Techniques, Addison-Wesley, ISBN-10:0201513765.
3. Neural Networks and Learning Machines, Simon Haykin, Third Edition, Pearson Education India
4. Neural Networks: A Classroom Approach, Satish Kumar, Second Edition, McGraw Hill Education, ISBN-10:1259006166.

Web Links:

1. https://www.youtube.com/playlist?list=PLE5BDB1D981F1C1AF
2. https://nptel.ac.in/courses/117105084?utm_source=chatgpt.com

INFORMATION RETRIEVAL SYSTEMS

Course Code: 2502DS08

L	T	P	C
1	0	2	3

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

CO1: Explain fundamentals of Information Retrieval and basic text processing techniques.
CO2: Describe data structures and indexing methods used in information retrieval.
CO3: Apply searching, ranking, and retrieval techniques for document collections.
CO4: Analyze text retrieval systems using classification and clustering methods.
CO5: Design and implement retrieval-based applications such as thesaurus and search engines.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	1	1	-	-
CO2	2	1	2	-	-	-
CO3	2	1	2	-	1	-
CO4	2	1	2	-	1	-
CO5	2	2	2	1	2	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	2	-
CO3	2	1
CO4	2	2
CO5	2	2

UNIT – I: Introduction to Information Retrieval

Introduction to Information Retrieval, Information Storage and Retrieval Systems, Document Collection, Tokenization, Stop Word Removal, Term Frequency, Document Frequency, Boolean Retrieval

Practice Programs:

1. Develop a program to perform tokenization on text documents using Python.
2. Demonstrate storing and retrieving information from the WWW using semantic approaches.
3. Write a program to remove stop words from a given text document.
4. Design a program to compute term frequency and document frequency for documents.
5. Create a simple Boolean retrieval system for document searching.

UNIT – II: Inverted Index and N-grams

Data Structures in Information Retrieval, Inverted Index, Index Construction Techniques, Inverted File Searching, N-grams, Spelling Error Detection

Practice Programs:

1. Construct an inverted index for a collection of documents using Python.
2. Analyze ranked retrieval of a large number of documents using hyperlink structure.
3. Generate N-grams for text data and analyze their usage.
4. Design a program to detect and correct spelling errors using N-grams.
5. Demonstrate document retrieval using inverted files.

UNIT – III: Searching and Compression

Sequential Searching, Pattern Matching, Web Searching, Hyperlink Analysis, Text Compression, Word Frequency Analysis

Practice Programs:

1. Perform sequential searching and pattern matching on text documents.
2. Write a program to search patterns in documents using string matching techniques.
3. Demonstrate searching of web documents using hyperlinks.
4. Develop a program to compress text files using Python.
5. Analyze compression efficiency based on word frequency.

UNIT – IV: Text Classification and Clustering

Text Classification, Feature Extraction, Bag of Words Model, Naïve Bayes Classifier, Text Clustering, K-Means Algorithm

Practice Programs:

1. Apply Naïve Bayes algorithm for text classification.
2. Extract features from text documents using Bag of Words model.
3. Evaluate the performance of text classification models.
4. Cluster text documents using K-Means algorithm.
5. Compare classification and clustering results on text data.

UNIT – V: Thesaurus and Applications of IR

Thesaurus Construction, Synonyms and Query Expansion, Ranked Retrieval, Web Search, Applications of Information Retrieval

Practice Programs:

1. Construct a thesaurus from text documents.
2. Expand user queries using thesaurus-based techniques.
3. Design a ranked retrieval system for document search.
4. Analyze document ranking using hyperlink-based methods.
5. Build a mini search engine using indexing and ranking techniques.

Additional Practice:

1. Compute TF-IDF scores for multiple documents to identify key terms.
2. Implement a positional inverted index that maps words to their positions for phrase queries.
3. Write a program to compress and decompress text using Run-Length Encoding (RLE).
4. Analyze sentiment in text data by classifying documents as positive or negative.
5. Design a query suggestion system that predicts completions using a thesaurus or previous queries.

Test Books:

1. Introduction to Information Retrieval, Christopher D.Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press, ISBN: 978-0-521-86571-5
2. Information Retrieval Data Structures and Algorithms, Frakes, W.B., Ricardo BaezaYates,Prentice Hall, ISBN: 978-0134638379
3. Modern Information Retrieval. BaezaYates Ricardo and Berthier RibeiroNeto., AddisonWesley, 2nd edition, ISBN: 978-8131709771

Reference Books:

1. Modern Information Retrieval, Ricardo BaezaYates, Neto, PEA. ISBN: 978-0321416919
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press. ISBN: 978-0792379249
3. Information Retrieval: Algorithms and Heuristics, Grossman, OphirFrieder,2/e, Springer. ISBN: 978-1461375326

Web Links:

1 https://nptel.ac.in/courses/106101007https://nptel.ac.in/courses/106101007

2 https://www.geeksforgeeks.org/what-is-information-retrieval/

NATURAL LANGUAGE PROCESSING

Course Code: 2502AI15	L	T	P	C
	2	0	1	3

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

CO1: Interpret systems of linear equations using matrix operations
CO2: Apply geometric concepts like inner products, orthogonality, and projections in analytic geometry.
CO3: Evaluate matrix decompositions such as Eigen and Singular Value Decomposition for dimensionality reduction.
CO4: Differentiate multivariate functions and apply gradient-based methods for vector calculus problems
CO5: Analyze probabilistic models and apply optimization techniques for continuous and constrained scenarios.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	-	-
CO2	3	2	2	2	-	-
CO3	3	2	3	2	-	1
CO4	2	2	3	2	-	-
CO5	2	2	2	3	-	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	3	2
CO4	3	2
CO5	2	2

UNIT-I

Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

Practice:
1. Implement a Finite-State Automaton (FSA) to recognize valid dates in the format "DD-MM-YYYY".
2. Create a spelling correction system using Minimum Edit Distance on a list of English words.

UNIT-II

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Practice:

1. Build and evaluate an unsmoothed and smoothed bigram language model on a small corpus
2. Implement a Part-of-Speech (POS) tagger using the Hidden Markov Model (HMM) with Viterbi decoding.

UNIT-III

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

Practice:

1. Parse English sentences using a Context-Free Grammar and visualize parse trees.
2. Implement a probabilistic CYK parser and test it on ambiguous sentences.

UNIT – IV

Semantics And Pragmatics: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Practice:

1. Perform Word Sense Disambiguation (WSD) using the Lesk algorithm on ambiguous words
2. Compute semantic similarity between word pairs using WordNet path similarity and cosine similarity from word embeddings.

UNIT-V

Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Practice:

1. Apply Hobbs and Centering algorithms for anaphora resolution in small English passages.
2. Use lexical resources like WordNet and PropBank to extract senses, synonyms, and semantic roles for a list of given verbs

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2 nd Edition, Daniel Jurafsky, James H. Martin—Pearson Publication.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media.

Reference Books:

1. Language Processing with Java and LingPipe Cookbook, 1 st Edition, Breck Baldwin, Atlantic Publisher.
2. Natural Language Processing with Java, 2 nd Edition, Richard M Reese, OReilly Media.
3. Handbook of Natural Language Processing, Second, NitinIndurkhya and Fred J. Damerau, Chapman and Hall/CRC Press.
4. Natural Language Processing and Information Retrieval, 3 rd Edition, TanveerSiddiqui, U.S. Tiwary, Oxford University Press.

Web Links:

1 https://archive.nptel.ac.in/courses/106/105/106105214/

2 https://archive.nptel.ac.in/courses/106/102/106102132/

ARTIFICIAL COGNITIVE SYSTEMS

Course Code: 2502CS11

L	T	P	C
2	0	1	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Compare various traditional approaches with cognitive computing.
CO2: Demonstrate tools associated with cognitive computing.
CO3: Design computational models of cognitive system.
CO4: Describe business implications of cognitive computing.
CO5: Explain the Unstructured Information Management Architecture.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	-	1	-
CO2	1	1	-	-	1	-
CO3	2	1	2	2	1	-
CO4	2	1	-	-	1	2
CO5	2	1	-	-	1	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	2	-
CO3	1	2
CO4	2	-
CO5	2	-

UNIT – I

Introduction to Cognitive Science: Understanding Cognition, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

UNIT – II

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

Practice:

1. Cognitive Architectures
2. Perception and Sensory Processing

UNIT – III

Cognitive Modeling:
Modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.
Practice:

1. Learning Algorithms
2. Reasoning and Decision Making
3. Cognitive Modeling

UNIT – IV

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development, Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.
Practice:

1. Natural Language Processing

UNIT – V

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.
Practice:

1. Case study: IBM Watson

Text Books:

1. The Cambridge Handbook of Computational Psychology by Ron Sun, Cambridge University Press. ISBN-13. 978-0521674102
2. Learning IBM Watson Analytics, James D Miller, Packt Publishing Ltd. ISBN 13: 9781785880773

Reference Books:

1. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press. ISBN-13. 978-0521190480
2. Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience by Bernard J. Bears, Nicole M. Gage, Academic Press. ISBN-13. 978-0123750709
3. Cognitive Computing and Big Data Analytics by Hurwitz, Kaufman, and Bowles, Wiley. ISBN-13. 978-1118896624

Web Links:

1. https://www.techtarget.com/searchenterpriseai/definition/cognitive-modeling/
2. https://www.slideshare.net/slideshow/cognitive-modeling-92473833/92473833/

CYBER SECURITY

Course Code: 2502DS09

L	T	P	C
2	0	1	3

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

CO1: Understand the basic concepts of information security, including characteristics, models, threats, and standards.
CO2: Apply classical and modern cryptographic techniques, access control methods, and steganography for secure communication.
CO3: Analyze network security mechanisms such as IDS, firewalls, VPNs, and forensic techniques.
CO4: Evaluate host and application security issues like buffer overflows, malware, and side-channel attacks with suitable defenses.
CO5: Examine security challenges in mobile, GSM, and wireless LAN systems and perform basic risk analysis and attack prevention.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2				
CO2		3	2			
CO3			3	2		
CO4		3		2		
CO5			2	3		

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	3	
CO2		3
CO3	3	
CO4		2
CO5	2	

UNIT – I

Critical characteristics of Information - NSTISSC Security Model - Components of information System - SDLC - Information assurance - Security Threats and vulnerabilities - Overview of Security threats - Security Standards.

Practice:
1. Information Security Awareness Tool
2. Basic Vulnerability Scanner for Windows/Linux

UNIT – II
Classical Cryptography - Symmetric Cryptography- Asymmetric Cryptography - Modern Cryptography - Access Control - DRM - Steganography - Biometrics.

Practice:

1. Encrypt and decrypt a message using the Caesar Cipher with a shift of 4.
2. Implement simple RSA key generation and encryption using Python or online tools.
3. Hide a secret message inside an image using basic LSB Steganography

UNIT – III

Network Security - Intrusion Prevention, detection and Management - Firewall - Ecommerce Security - Computer Forensics - Security for VPN and Next Generation Networks.

Practice:

1. Create a simple firewall rule table allowing and denying specific ports.
2. Analyze a sample network log and identify at least 3 suspicious activities.

UNIT – IV

Host and Application security -Control hijacking, Software architecture and a simple buffer overflow - Common exploitable application bugs, shellcode - Buffer Overflow - Side-channel attacks - Timing attacks, power analysis, cold-boot attacks, defences - Malware - Viruses and worms, spyware, key loggers, and botnets; defences auditing, policy - Defending weak applications - Isolation, sandboxing, virtual machines.

Practice:

1. Simulate a small buffer overflow in Python/Java by exceeding array limits.
2. Buffer Overflow Demonstration

UNIT – V

Mobile, GSM and Wireless LAN security - Protection measures - Business risk analysis - Information Warfare and Surveillance - Case study on Attack prevention, detection and response.

Practice:

1. Wi-Fi Security Analyzer (Basic)
2. Mobile Security Awareness App (Prototype)

Additional Practice:

1. Create a strong password policy for students in your college and explain why each rule (length, symbols, expiry) is important.
2. Perform encryption using any two methods (one classical like Caesar/Vigenère and one modern like AES/RSA) and compare their security levels.
3. Identify 5 vulnerabilities in any mobile phone and propose simple protection methods for each.
4. Simulate a small set of network traffic logs and detect suspicious activities (e.g., multiple failed logins, unknown IP access).

Text Books:

1. William Stallings, “Cryptography and Network Security: Principles and Practice”, 6th Edition, PHI.
2. Michael E. Whitman and Herbert J Mattord, “Principles of Information Security”, 6th Edition, Vikas Publishing House.

Reference Books:

1. Bill Nelson, Amelia Phillips, F. Enfinger and Christopher Stuart, “Guide to Computer Forensics and Investigations”, 4th Edition, Thomson Course Technology.
2. Matt Bishop, “Computer Security: Art and Science”, 1st Edition, Addison-Wesley Professional.

Web Links:

1. https://nptel.ac.in/domains/discipline/106?course=106_5
2. https://www.coursera.org/courses?query=cybersecurity

ADVANCED DATA MINING

Course Code: 2502AI21

L	T	P	C
2	0	1	3

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

CO1: Understand data mining methodologies (CRISP-DM, SEMMA) and predictive modelling techniques including decision trees and Bayesian methods.
CO2: Apply frequent itemset generation and association rule mining algorithms like Apriori and FP-Growth and analyse data correlations.
CO3: Analyse advanced association mining with categorical/continuous data, sequential pattern mining, and frequent subgraph mining.
CO4: Implement and compare clustering techniques such as K-means, Hierarchical Clustering, and DBSCAN on various datasets.
CO5: Evaluate clustering algorithms, mine complex data types (text, spatial, graph), and apply preprocessing for real-world applications

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	2	-	-
CO2	3	-	2	2	-	-
CO3	2	-	3	3	-	-
CO4	2	-	3	3	-	-
CO5	3	2	2	2	2	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	2
CO2	3	2
CO3	3	3
CO4	2	2
CO5	3	2

UNIT-I

Data Mining Methodologies: CRISP-DM and SEMMA, Comparison of Data Mining Methodologies. Statistical Limits on Data Mining, Introduction to Predictive Analytics, **Classification** & Prediction: Predictive Modelling; Concepts, General Approach to solving a classification problem, - ZeroR, OneR, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Model Evaluation and Selection, Visualization techniques and experiments with weka.

Practice:

1. Use a dataset with student demographics and academic records to build and evaluate a model that classifies students as pass/fail
2. Build a decision tree and Naive Bayes classifier. Compare accuracy, precision, and recall.

UNIT-II

Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm, Generating item sets and rules efficiently, Covariance and Correlation analysis.

Practice:

1. Given a transaction dataset from a retail store, generate frequent itemsets and association rules using Apriori and FP-Growth
2. Use a dataset of book purchases to find strong rules with minimum support 30% and confidence 70%. Interpret the top 5 rules.

UNIT-III

Advanced Concepts on Association Analysis: Handling Categorical and Continuous Attributes, handling a Concept Hierarchy, Sequential Patterns: Preliminaries, Sequential Pattern Discovery, Timing Constraints, Alternative Counting Schemes; Subgraph Patterns: Preliminaries: Frequent Subgraph Mining, Candidate Generation, Candidate Pruning, Support Counting

Practice:

1. Use sequential transaction data to find patterns like "if a user buys A → B → C".
2. Use molecular graph data to identify frequent substructures across compounds.

UNIT-IV

Clustering: Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center- Approach, DBSCAN Algorithm, Strengths and Weaknesses**.**

Practice:

1. Apply K-means on a dataset with GDP, literacy rate, and life expectancy to find similar countries.
2. Analyze the differences in clusters formed by DBSCAN vs. K-means and interpret their strengths.

UNIT-V

Cluster Analysis - Additional Issues and Algorithms: Cluster Evaluation, Characteristics of Data, Clusters, and Clustering Algorithms. (Tan &Vipin Kumar) Mining rich data

types: Mining text data, Spatial-temporal data, Graph and networks Mining real data: preprocessing
data from a real medical domain, data mining techniques to create a comprehensive and accurate model of data.

Practice:

1. Use TF-IDF to vectorize text and apply K-means to group articles into topics like politics, sports, technology.
2. Use a pre-processed medical dataset (e.g., patient symptoms and diagnoses) to build a predictive model using classification or clustering.

Text Books:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, AnujKarpatne, Vipin Kumar, 2nd edition
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 4th edition

References:

1. Fundamentals of Data Warehouses, 2nd edition,Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer

Web Links:

1. https://nptel.ac.in/courses/106105174/
2. http://cse20-iiith.vlabs.ac.in/

INTELLIGENT SYSTEMS

Course Code: 2502DS10

L	T	P	C
2	0	1	3

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

CO1: Demonstrate the ability to represent and reason with data in various knowledge representation schemes like semantic nets, frames, and rules.

CO2: Apply forward and backward reasoning techniques to solve real-world problems, and execute these methods through depth-first search, breadth-first search, and A* search.

CO3: Develop knowledge-based systems using tools like Lisp and Prolog, and implement expert system shells for decision-making.

CO4: Solve real-time system problems by designing intelligent subsystems and synchronizing them with real-time subsystems, using appropriate communication methods.

CO5: Analyze and apply qualitative reasoning techniques like qualitative simulation and Petri nets for intelligent control and decision-making in dynamic systems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1	2	1	-
CO2	2	1	3	2	1	2
CO3	1	2	3	3	2	2
CO4	2	1	2	3	2	2
CO5	2	2	3	1	2	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT – I

Knowledge Representation: Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets, dependence graph of data log rule sets, Objects Frames, Semantic nets, Solving problems by reasoning: The structure of the knowledge base, The reasoning algorithm, Conflict resolution, Explanation of the reasoning.

Practice:

1. Installation and working of various AI tools: Python, R Tool, GATE, NLTK, MATLAB, etc.
2. Data preprocessing, annotation, and creation of datasets.
3. Implementation of Logical Operations for Knowledge Representation.

UNIT – II

Rule Based Systems: Forward reasoning: The method of forward reasoning, A simple case study of forward reasoning. Backward reasoning: Solving problems by reduction, The method of backward reasoning, A simple case study of backward reasoning, Bidirectional reasoning. Search Methods: Depth-first search, Breadth first search, Hill climbing search, A* search.

Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness

Completeness: The notion of completeness, Testing Completeness, The search problem of completeness. Decomposition of knowledge bases: Strict decomposition, Heuristic decomposition

Practice:

1. Implementation of Depth First Search (DFS) using Python.
2. Implementation of Breadth First Search (BFS) using Python.
3. Implementation of Hill Climbing Algorithm using Python.

UNIT – III

Tools for Representation and Reasoning: The Lisp programming language: The fundamental data types in Lisp, Expressions and their evaluation, Some useful Lisp primitives, Some simple examples in Lisp, The Prolog programming.

Language: The elements of Prolog programs, The execution of Prolog programs, Built-in predicates, and some simple examples in Prolog. Expert system shells: Components of an expert system shell, Basic functions and services in an expert system shell.

Practice:

1. Implementation of Simulated Annealing Algorithm using LISP.
2. Implementation of Simulated Annealing Algorithm using PROLOG.
3. Implementation of BFS for Tic-Tac-Toe Problem using LISP.

UNIT – IV

Real-Time Expert Systems: The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem. Synchronization and communication between real-time and intelligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time.

Intelligent subsystems: Loose data exchange, The blackboard architecture. Software engineering of real-time.

Expert systems: The software lifecycle of real-time expert systems, Special steps and tool, An Example of A Real-Time expert System.

Practice:

1. Study of Tools and Steps used in Real-Time Expert System development.
2. Implementation of a Simplified Blackboard Architecture.
3. Implementation of an Expert System using Forward Chaining.

UNIT – V

Qualitative Reasoning and Petri Nets: Sign and interval calculus, Qualitative simulation: Constraint type, qualitative differential equations, The solution of QDEs.

Qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models, The Notion of Petri nets, the firing of transitions, Special cases and extensions, the state-space of Petri nets the use of Petri nets for intelligent control, The analysis of Petri nets: Analysis Problems for Petri Nets, Analysis techniques.

Practice:

1. Implementation of Sign Calculus and Interval Calculus for Qualitative Reasoning.
2. Qualitative Simulation of a Dynamic System using Qualitative Differential Equations (QDEs).
3. Modelling and Analysis of a System using Signed Directed Graphs (SDGs).

Text Books:

1. Intelligent Control Systems-An Introduction with Examples, Katalin M. Hangos, RozáliLakner , MiklósGerzson, Kluwer Academic Publishers.
2. Artificial Intelligence: A Modern Approach Stuart Russell, Peter Norvig, *Pearson Education*, 3rd Edition.

Reference Books:

1. Intelligent Systems and Control: Principles and Applications Paperback, Laxmidhar Behera, IndraniKar by OXFORD.
2. Intelligent Systems Springerpublications. and Technologies Methods and Applications,

Web Links:

1. https://www.clipsrules.net/
2. https://www.swi-prolog.org/
3. https://ocw.mit.edu/
4. https://www.petrinets.info/

DATA PREPARATION AND ANALYTICS

Course Code: 2502DS11

L	T	P	C
2	0	1	3

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

CO 1: Understand and apply data gathering, parsing, and preparation techniques for structured and semi-structured data.
CO 2: Clean, transform, and segment data by handling missing, inconsistent, and heterogeneous datasets.
CO 3: Perform exploratory data analysis using descriptive statistics, clustering, association, and hypothesis generation techniques.
CO 4: Design and interpret effective visualizations for time-series, geolocated, correlated, and hierarchical data.
CO 5: Use R or Python visualization tools to analyze, interpret, and communicate insights from complex datasets, including interactive visualizations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	3	2	1			
CO2	3	3	2			
CO3	2	3	2	1		
CO4	2	2	3	2	1	
CO5	2	2	2	3	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	2	3
CO5	3	2

UNIT-I
Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.
Practice:

1. Load datasets in CSV, JSON, and Excel formats using Python/R and convert them into a unified data structure.
2. Parse semi-structured data and perform basic data transformation (type conversion, column renaming, filtering).
3. Simulate a real-time data stream and discuss scalability challenges while processing large datasets.

UNIT-II

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

Practice:

1. Identify and handle missing values using appropriate imputation techniques.
2. Detect and resolve data inconsistencies and heterogeneous data formats in a given dataset.

UNIT-III

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

Practice:

1. Compute and interpret descriptive statistics for a dataset and compare multiple variables.
2. Apply clustering techniques to group similar data points and analyze the results.

UNIT – IV

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

Practice:

1. Design effective visualizations for time-series data and analyze trends.
2. Create visualizations for correlations, connections, or networks in data.

UNIT – V

Overview of visualization tools in R / Python: Visualization for data preparation and exploratory analysis, Plotting distributions, comparisons, and relationships, Visualization of time-series and multivariate data, Correlation and cluster visualization, Interactive visualizations.

Practice:

1. Create visualizations for data preparation and exploratory analysis using R or Python libraries.
2. Plot distributions, comparisons, relationships, and multivariate data using suitable charts.
3. Develop interactive visualizations for correlation and clustering analysis.

Text Books:

1. Glenn J. Myatt, “Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining”, 2nd Edition, John Wiley Publishers.
2. Data Analysis and Visualization Using Python — Ossama Embarak (Apress) (covers data analysis, visualization techniques, Matplotlib & Seaborn integration)

Reference Books:

1. Python Data Visualization Essentials Guide — Kalilur Rahman (practical coverage of NumPy, Pandas, Matplotlib, Seaborn, Plotly)
2. Hands-On Data Visualization: Interactive Storytelling from Spreadsheets to Code - Jack Dougherty & Ilya Ilyankou (visualization principles alongside Python & data analytics best practices)

Web Links:

1. https://realpython.com/tutorials/data-viz/
2. https://www.dataquest.io/path/data-analysis-and-visualization-with-python/

BLOCK CHAIN TECHNOLOGY

Course Code: 2502CS21

L	T	P	C
2	0	1	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1**:** Demonstrate the foundation of the Blockchain technology
CO2: Identify the risks involved in building Blockchain applications.
CO3: Explain crypto currency relating with blockchain.
CO4: Illustrate the landscape of Ethereum Blockchain.
CO5: Summarize hyper ledger in blockchain

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	-	-	-	-
CO2	2	-	1	-	-	-
CO3	1	1	1	1	-	-
CO4	1	2	2	2	1	-
CO5	1	2	2	2	1	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	1
CO3	2	-
CO4	2	-
CO5	2	-

UNIT – I

Introduction: Introduction to Blockchain, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain.

Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution Public Blockchain Environments

Practice:

1. Understanding Blockchain Characteristics through a Simple Ledger Example
2. Simulating a Decentralized vs. Centralized Application

UNIT – II

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Consensus, Mining and Finalizing Blocks, security on blockchain, data storage on blockchain, wallets, **Coding on Blockchain:** Smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

Practice:

1. Simulating Block Creation and Hashing in a Blockchain
2. Creating and Deploying a Basic Smart Contract using Solidity

UNIT – III

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, and Types of Blockchain Applications.

Crypto currency and Wallet: Types of Wallets, Desktop Wallet, App based Wallet, Browser based wallet, Metamask, Creating an account in Metamask, transfer of crypto currency in metamask.

Practice:

1. Evaluating the Use of Blockchain for a Simple Application
2. Setting Up a MetaMask Wallet and Transferring Cryptocurrency

UNIT – IV

Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Ethereum Clients, Decentralized Application.

Practice:

1. Building a Simple Tuna Fish Tracking Smart Contract on Ethereum
2. Creating an Ethereum Account and Managing Funds with MyEtherWallet

UNIT – V

Hyperledger Blockchain Implementation: Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, Invoking Chaincode Functions Using Client Application. Advanced Concepts in Blockchain: Introduction, InterPlanetary File System (IPFS), Blockchain Cloud Offerings, Blockchain and its Future Potential.

Practice:

1. Simulating Car Ownership Tracking Using Hyperledger Fabric
2. Exploring IPFS (InterPlanetary File System) for Blockchain Data Storage

Text Books:

1. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly ISBN : 978-1491920497
2. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashier, Packt publishing ISBN : 978- 1787125445

Reference Books:

1. Mastering Ethereum: Building Smart Contracts and DApps by Andrews ISBN : 978- 1491971949
2. Mastering Bitcoin: Programming the Open Blockchain, by Andreas M. Antonpoulos, O'Reilly ISBN : 978-9352135745

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview/
2. https://github.com/blockchainedindia/resources/
3. https://github.com/HyperledgerHandsOn/trade-finance-logistics/

COMPUTER VISION TECHNIQUES

Course Code: 2502DS12

L	T	P	C
2	0	1	3

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

CO1: Explain the fundamentals of computer vision including image processing, filtering, thresholding, and edge/corner detection.
CO2: Apply feature detection, Hough Transform, RANSAC, Fourier transforms, and image formation techniques for object analysis.
CO3: Analyse segmentation and shape modelling methods such as active contours, mean shift, normalized cuts, and graph cuts.
CO4: Evaluate 3D reconstruction techniques including triangulation, structure from motion, and bundle adjustment.
CO5: Design image rendering and panorama stitching methods using motion models and projection techniques.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	3	2	-	-	2	-
CO2	3	3	2	2	3	-
CO3	3	3	2	3	2	-
CO4	3	3	3	3	2	-
CO5	3	3	3	2	3	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	2	1
CO3	2	
CO4	1	2
CO5	1	2

UNIT-I

Introduction to Computer Vision: Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection.

Practice:
1. Implementation of 2D and 3D Projections
2. Build a color constancy algorithm that uses the assumption that the spatial average of reflectance is constant. Use finite-dimensional linear models.

UNIT-II

Image Formation : Points and patches-An Introduction - Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition - Feature detectors -Feature descriptors, Matching - Feature tracking - Edge detection - Edge linking - Successive approximation - Hough transforms -Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location– speed problem – ellipse detection

Practice:

1. Implementation Two-dimensional Fourier transforms, Wiener filtering
2. 2.Write a program that produces a Gaussian pyramid from an image

UNIT-III

Image Processing Techniques: Active contours - Snakes -Dynamic snakes and Condensation - Scissors, Level Sets - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods - 2D and 3D feature based alignment - Pose estimation

Practice:

1. Obtain an implementation of Canny's edge detector
2. Implement a Hough transform based line finder

UNIT – IV

Computational Photography: Triangulation - Two-frame structure from motion - Projective reconstruction - Self-calibration - Perspective and projective factorization - Bundle adjustment - Exploiting sparsity - Constrained structure and motion - Hierarchical motion estimation - Fourier-based alignment - Incremental refinement

Practice:

1. Count lines with an HT line finder. How well does it work?
2. Implement a mean shift segmenter

UNIT-V

Image Rendering: Motion models - Planar perspective motion - Rotational panoramas - Gap closing - Cylindrical and spherical coordinates - Bundle adjustment - Parallax removal - Recognizing panoramas – Compositing

Practice:

1. Case Study

Additional Practice:

1. Implement contrast adjustment of an image. Implement Histogram processing and equalization.
2. Use of Fourier transform for filtering the image.

Text Books:

1 Computer Vision: Algorithms and Applications, Richard Szeliski,Springer, ISBN-10. 1848829345 · ISBN-13. 978-1848829343.

2 Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall ISBN:978-9332550117

Reference Books:

1 S Computer Vision and Image Processing, S. Nagabhushana, New Age International Pvt Ltd; First edition, ISBN: 978-8122416428

2 Digital Image Processing, Rafael C. Gonzalez, Pearson Education; Fourth edition,ISBN 9789353062989.

3 Computer and Robot Vision, Haralick & Shapiro, Vol II, ISBN: 978-0201569438

Web links:

1. https://onlinecourses.nptel.ac.in/noc22_ee48/preview
2. https://www.geeksforgeeks.org/computer-vision/

FUZZY LOGIC AND FUZZY SETS

Course Code: 2502DS13

L	T	P	C
2	0	1	3

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

CO1: Understand the fundamentals of fuzzy sets and uncertainty concepts.
CO2: Analyze and compare crisp sets and fuzzy sets with their representations.
CO3: Apply fuzzy set operations such as union, intersection, and complement.
CO4: Understand fuzzy logic principles, linguistic variables, and fuzzy rules.
CO5: Design and implement fuzzy inference systems and fuzzy models for real-world problems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	2	3	2	1	1	1
CO3	2	2	3	2	1	1
CO4	2	2	2	3	2	1
CO5	1	2	3	3	2	2

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	3	2
CO4	3	2
CO5	3	3

UNIT – I

Fuzzy Set: Introduction, uncertainty, Newtonian mechanics, Probability Theory, organized simplicity, disorganized complexity, trans computational problems.
Practice:

1. Explain the concept of uncertainty in fuzzy systems.
2. Define fuzzy sets and explain their need in real-world problems.
3. Compare classical logic and fuzzy logic.

UNIT – II

Crisp Sets: An overview, **fuzzy sets:** Basic types, basic concepts. Fuzzy sets versus crisp sets, additional properties of alpha-cuts, representations of fuzzy sets.
Practice:

1. Define crisp sets and fuzzy sets. Compare them with examples.
2. Explain α-cuts and their properties.
3. Describe different methods of representing fuzzy sets.

UNIT – III

Operations on Fuzzy sets: Types of operations, fuzzy complements, Fuzzy instructions: t-Norms. Fuzzy Unicons: t-co norms, combination of operations, aggregation operations.

Practice:

1. Explain operations on fuzzy sets (union, intersection, complement).
2. Define t-norms and t-conorms with examples.
3. Explain aggregation and composition of fuzzy relations.

UNIT – IV

Fuzzy Logic: Classical logic, logic, reasoning, propositional logic, logic operation's logic formulas, tautology, inference rules, Boolean algebra, properties of Boolean algebra, quantification, predicate logic, multi-valued logic, fuzzy propositions, fuzzy quantifiers, linguistic hedges.

Practice:

1. Explain propositional logic and predicate logic in fuzzy systems.
2. Describe Boolean algebra and its properties.
3. Explain fuzzy propositions and fuzzy quantifiers.

UNIT – V

Inference from conditional Fuzzy propositions, Inference from conditional and quantified propositions. Mamdani fuzzy models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Model, Input space partitioning, Fuzzy modelling.

Practice:

1. Explain fuzzy inference systems and their components.
2. Describe Mamdani fuzzy model with block diagram.
3. Explain fuzzy modeling and input space partitioning.

Text Books:

1. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India.
3. S. Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI Learning.
4. Jang, Sun and Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall.

Reference Books:

5. Li Min Fu, Neural Networks in Computer Intelligence, McGraw-Hill.
6. Bart Kosko, Fuzzy Engineering, Prentice Hall.
7. Zimmermann, Fuzzy Set Theory and Its Applications, Springer.
8. Klir and Folger, Fuzzy Sets, Uncertainty and Information, Prentice Hall.

Web Links:

1. https://www.tutorialspoint.com/fuzzy_logic
2. https://www.geeksforgeeks.org/fuzzy-logic-introduction

RECOMMENDER SYSTEMS

Course Code: 2502AI19

L	T	P	C
2	0	1	3

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

CO1: Understand the core functions and applications of recommender systems, along with mathematical foundations such as matrix operations and covariance matrices.

CO2: Analyse and implement collaborative filtering techniques, including user-based, item-based, and model-based approaches, and identify associated challenges like system attacks.

CO3: Apply content-based and knowledge-based recommendation methods using item/user profiles, document features, and similarity or classification algorithms

CO4: Evaluate and design hybrid recommender systems by integrating various strategies such as feature combination, weighted approaches, and meta-level architectures.

CO5: Assess the effectiveness of recommender systems using evaluation metrics and understand the role of social, trust-based, and community-based recommendation approaches.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	-	1
CO2	3	3	2	1	2	1
CO3	2	3	2	1	-	2
CO4	2	3	3	2	1	2
CO5	3	2	2	-	1	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	2
CO2	1	1
CO3	1	3
CO4	2	2
CO5	2	2

UNIT-I Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Practice:

1. Given a small user-item rating matrix, perform matrix addition, transposition, and compute the covariance matrix to analyze rating patterns.
2. List and explain at least three real-world applications of recommender systems and discuss the primary challenges (e.g., cold start, sparsity) faced by each.

UNIT – II

Collaborative Filtering: User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

Practice:

1. Implement a user-based collaborative filtering system on a movie rating dataset using cosine similarity to recommend top 5 movies.
2. Simulate an attack on a collaborative filtering system (e.g., profile injection) and observe how it affects recommendation outcomes.

UNIT – III

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms. Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

Practice:

1. Create item profiles using tags or text descriptions for a sample product dataset and compute similarity scores using TF-IDF.
2. Implement a constraint-based recommender (e.g., for travel packages or laptops) that filters items based on user-specified attributes.

UNIT – IV

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation. **Parallelized hybridization design:** Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

Practice:

1. Design a hybrid recommender combining content-based and collaborative filtering using a weighted method and evaluate its output.
2. Create a flowchart showing a pipelined hybrid recommender system using the cascade or meta-level strategy for book recommendations.

UNIT – V

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision Support metrics, User-Centred metrics. Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, social tagging recommender systems, Trust and recommendations

Practice:

1. Evaluate a recommender system using RMSE, Precision, and Recall on historical rating data and interpret the results.

2. Analyze the role of trust in recommender systems by comparing recommendations from social tagging platforms vs. anonymous systems

Text Books:

1. Jannach D., Zanker M. andFelFering A., Recommender Systems: An Introduction, Cambridge University Press, 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer, 1st ed.

Reference Books:

1. sManouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems for Learning, Springer (2013), 1st ed.

Web Links:

1. https://www.coursera.org/specializations/recommender systems
2. https://nptel.ac.in/courses/

AI FOR LANGUAGE AND TEXT PROCESSING

Course Code: 2502CS17

L	T	P	C
2	0	1	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers

CO2: Realize semantics and pragmatics of English language for text processing

CO3: Select a suitable language modeling technique based on the structure of the language

CO4: Summarize morphology and NLP applications

CO5: Perform POS tagging for a given natural language

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	-	2	-	-
CO2	2	-	2	-	-	-
CO3	2	1	-	2	1	-
CO4	1	-	2	-	-	-
CO5	2	-	2	-	-	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

UNIT – I

Introduction to NLP: Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross entropy.

UNIT – II

Text Preprocessing: Tokenization, Stemming, Text Preprocessing & Feature Representation Introduction to Corpora, Sentence Segmentation, Stemming: Porter Stemmer, Bag of words and Vector Space Model, Topic Modelling, Ngram Language Model, Smoothing.

Practice:

1. Word Analysis

UNIT – III

Language Modelling: Words: Collocations- Frequency-Mean and Variance –Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios. Statistical Inference: n -gram Models over Sparse Data: Bins: Forming Equivalence Classes- N gram model - Statistical Estimators- Combining Estimators

Practice:

1. Word Generation

UNIT – IV

Morhpology: Sequence Labeling for Parts of Speech and Named Entities, PartofSpeech Tagging, Named Entities and Named Entity Tagging , HMM PartofSpeech Tagging , Conditional Random Fields (CRFs), Evaluation of Named Entity Recognition Applications of NLP Machine Translation Encoder & Decoder Model, Attention Models, Question Answering Knowledge based Q&A Chatbots & Dialogue Systems, Automatic Speech Recognition and Text to Speech

Practice:

1. Morphology
2. N-Grams, N-Grams Smoothing

UNIT – V

Markov Model and POS Tagging: Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging

Practice:

1. POS Tagging: Hidden Markov Model
2. POS Tagging: Viterbi Decoding
3. Building POS Tagger, Chunking

Text Books:

1. Speech and Language Processing, Dan Jurafsky, James H. Martin Draft of 3rd Edition, Prentice Hall 2022, ISBN: 978-0130950697
2. Springer Handbook of Speech Processing, Jacob Benesty, M. M. Sondhi, Yiteng Huang Springer, ISBN: 978-3662533000

Reference Books:

1. Speech and Language Processing, Daniel Jurafsky and James H. Martin. 2020. 3rd Edition (draft), ISBN: 978-0135041963
2. Foundations of Statistical Natural Language Processing, Christopher, D. Manning and Hinrich Schütze, MIT Press, ISBN: 978-0262133609

Web Links:

1. https://nptel.ac.in/courses/106105158/
2. https://nptel.ac.in/courses/106106211/

REINFORCEMENT LEARNING

Course Code: 2502AI26

L	T	P	C
2	0	1	3

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

CO 1: Understand basic concepts of Reinforcement learning.
CO 2: Identifying appropriate learning tasks for Reinforcement learning techniques.
CO 3: Implement and apply adversarial training techniques to train GAN models.
CO 4: Analyse the applications of VAEs in various domains such as image generation, anomaly detection, and data imputation.
CO 5: Evaluate the ethical considerations and societal impact of reinforcement learning and generative AI technologies.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	-	2	-
CO2	2	2	-	-	-	-
CO3	3	2	-	-	-	-
CO4	3	2	1	-	-	-
CO5	2	1	1	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	1
CO3	3	1
CO4	2	-
CO5	2	1

UNIT-I

Basics of reinforcement learning (RL): RL components: agents, environments, rewards Markov Decision Processes (MDPs), Exploration vs. Exploitation dilemma, Basic algorithms: Q-learning, SARSA, Monte-Carlo (MC) Learning, Temporal-Difference (TD) Learning, TD-Lambda and Eligibility Traces

Practice:
1. Installation of TensorFlow and implement the basic programs.
2. Installation of PYTORCH and implement the basic programs.

UNIT-II

Advanced Reinforcement Learning Techniques: Deep Q-Networks (DQN), Policy Gradient methods, Actor-Critic architectures, Advantage Actor-Critic (A2C) and Proximal

Policy Optimization (PPO), Continuous action spaces and algorithms like Deep Deterministic Policy Gradient (DDPG)

Practice:

1. Implement a simple grid world environment where an agent learns to navigate from a starting point to a goal while avoiding obstacles.
2. Train an agent to balance a pole on a cart using discrete actions such as pushing the cart left or right.

UNIT-III

Generative Adversarial Networks (GANs): Introduction to generative models, Basics of GANs: generator, discriminator, Training GANs: adversarial training, Variants of GANs: Conditional GANs, Wasserstein GANs, etc, Applications of GANs in image generation, style transfer, and data augmentation

Practice:

1. Model an agent learning to drive a car up a steep mountain by applying the correct amount of throttle and braking.
2. Train an agent to play the classic game of Pong, where it learns to control a paddle to hit a ball back to the opponent while preventing it from reaching its own side.

UNIT-IV

Variational Autoencoders (VAEs): Introduction to autoencoders, Variational inference and latent variable models, Encoder and decoder architectures in VAEs, Training VAEs: maximizing evidence lower bound (ELBO), Applications of VAEs in image generation, anomaly detection, and data imputation.

Practice:

1. Use deep reinforcement learning to train an agent to play various Atari games, such as Breakout, Space Invaders, or Pac-Man.
2. Experiment with different strategies for solving the multi-armed bandit problem, where an agent must decide which arm of a slot machine to pull to maximize cumulative reward.
3. Design an agent to control traffic lights at intersections to optimize traffic flow and reduce congestion.

UNIT-V

Advanced Topics in Reinforcement Learning and Generative AI: Model-based RL and world models, multi-agent reinforcement learning, Transfer learning and meta-learning in RL, Adversarial attacks and defences in generative models, Ethical considerations and societal impact of RL and generative AI

Practice:

1. Train an agent to play Flappy Bird, a side-scrolling game where the agent controls the flight of a bird through a series of pipes.
2. Develop an agent capable of playing Tic-Tac-Toe optimally against a human opponent or another agent.

3. Simulate a colony of ants foraging for food in a dynamic environment, where the agent learns to find and retrieve food while avoiding obstacles and predators.

Additional Practice:

1. Train a robotic arm to perform various tasks, such as reaching a target location or manipulating objects, using reinforcement learning.
2. Develop a trading agent that learns to make profitable trades in financial markets by analysing historical data and adapting its trading strategy over time

Text Books:

1 R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press.

Reference Books:

1 Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool.

2 Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

INTERNET OF THINGS

Course Code: 2502CS12

L	T	P	C
2	0	1	3

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

CO1: Describe the sensors and actuators for an IoT application
CO2: Optimizing IP for IoT using 6LoWPAN.
CO3: Make the Use of the RaspberryPi with Python Programming
CO4: Explain the difference between the Structured vs Unstructured implement Multiple tools.
CO5: Summarize the important role of IOT in agriculture.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	-	-	1
CO2	1	2	1	-	-	-
CO3	1	2	2	-	-	2
CO4	1	2	1	-	-	-
CO5	1	-	1	-	-	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	2
CO2	2	2
CO3	1	2
CO4	2	2
CO5	1	-

UNIT – I

Fundamentals of IoT: Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge, and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Practice:

1. Write a program to sense the available networks using in Ardunio.

UNIT – II

IoT Protocols: IoT Access Technologies: Physical and MAC layers, topology, and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network
Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application

Transport Methods: Supervisory Control and Data Acquisition – Application Layer. Protocols: CoAP and MQTT.

Practice:

1. To write a program to measure the distance using ultrasonic sensor and make LED blink using Arduino.

UNIT – III

Design and Development: Design Methodology - Embedded computing logic - Microcontroller, System on Chips -IoT system building blocks - Arduino - Board details, IDE programming – Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Practice:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation

UNIT – IV

Data Analytics and Supporting Services: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka Apache Spark – Edge Streaming Analytics and Network Analytics.

Practice:

1. To install MySQL database on Raspberry Pi and perform basic SQL queries.

UNIT – V

IoT Case Studies: Agricultural IoT, Components of an agricultural IoT, Advantages of IoT in agriculture, Case Studies, Vehicular IoT, Components of vehicular IoT, Advantages of vehicular IoT, Healthcare IoT, Components of healthcare IoT, Advantages and risk of healthcare IoT.

Practice:

1. Case Study on Agriculture IOT.

Text Books:

1. "The Internet of Things Connecting Objects to the Web" Hakima Chaouchi, Wiley Publications ISBN : 978-1-84821-140-7,
2. "The Internet of Things: Key Applications and Protocols", Olivier Hersent, David Boswarthick, and Omar Elloumi, Wiley Publications ISBN-13: 978-1848214783.

Reference Books:

1. Introduction to IOT, Sudip Mishra, Anandarup Mukherjee, Arijit Roy, Cambridge University Press, ISBN: 978-1108495059.
2. "Enabling things to talk", Bassi, Alessandro, et al, Springer-Verlag Berlin. David Hanes,Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, ISBN: 978- 3642379578.
3. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro , Patrick Grossetete , Robert Barton , Jerome Henry , CISCO Press. ISBN: 978-1587144575.
4. Arduino Applied-Comprehensive Projects for Everyday Electronics, Neil Cameron, Apress ISBN: 978-1484209954

Web Links:

1. https://www.javatpoint.com/iot-internet-of-things/
2. https://www.tutorialspoint.com/internet_of_things/index.htm/

HEALTH CARE DATA ANALYTICS

Course Code: 2502DS14

L	T	P	C
2	0	1	3

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

CO1: Explore healthcare data sources, EHR systems, standards, and challenges.
CO2: Analyze biomedical signals, images, sensor, and genomic healthcare data.
CO3: Apply data mining and NLP techniques on clinical and biomedical text data.
CO4: Design advanced predictive and visual analytics models for healthcare applications.
CO5: Develop analytics-based solutions for real-world healthcare and medical decision systems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2				
CO2	2	3	2			
CO3		2	3	2		
CO4			3	2	2	
CO5			2	2	3	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	2	3
CO5	2	3

UNIT – I

Introduction: Introduction to Healthcare Data Analytics - Electronic Health Records- Components of EHR - Coding Systems- Benefits of EHR - Barrier to Adopting HER Challenges - Phenotyping Algorithms.

Practice:

1. Analyze a sample EHR dataset and identify key components.
2. Map ICD-10/CPT codes to disease categories.
3. Implement a simple phenotyping algorithm for a disease.

UNIT – II

Analysis: Biomedical Image Analysis - Mining of Sensor Data in Healthcare - Biomedical Signal Analysis - Genomic Data Analysis for Personalized Medicine.

Practice:

1. Preprocess and segment a biomedical image.
2. Filter and extract features from ECG/EEG signals.

3. Analyze genomic data for disease-related patterns.

UNIT – III

Analytics: Natural Language Processing and Data Mining for Clinical Text - Mining the Biomedical - Social Media Analytics for Healthcare.

Practice:

1. Apply NLP on clinical notes to extract medical terms.
2. Perform text mining on biomedical research abstracts.
3. Conduct sentiment analysis on healthcare social media data.

UNIT – IV

Advanced Data Analytics: Advanced Data Analytics for Healthcare - Review of Clinical Prediction Models - Temporal Data Mining for Healthcare Data - Visual Analytics for Healthcare - Predictive Models for Integrating Clinical and Genomic Data - Information Retrieval for Healthcare - Privacy-Preserving Data Publishing Methods in Healthcare.

Practice:

1. Build a clinical risk prediction model.
2. Perform temporal analysis on patient time-series data.
3. Apply data anonymization for privacy preservation.

UNIT – V

Applications: Applications and Practical Systems for Healthcare - Data Analytics for Pervasive Health - Fraud Detection in Healthcare - Data Analytics for Pharmaceutical Discoveries - Clinical Decision Support Systems - Computer - Assisted Medical Image Analysis Systems - Mobile Imaging and Analytics for Biomedical Data.

Practice:

1. Detect anomalies in healthcare insurance data.
2. Develop a basic clinical decision support system.
3. Analyze mobile or medical image data for health insights.

Textbooks:

1. Chandan K. Reddy and Charu C Aggarwal, “Healthcare data analytics”, 1st Edition, Taylor & Francis.
2. Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement”, 1st Edition, Wiley.

Reference Books:

1. J. H. Holmes et al., Data Mining for Healthcare, CRC Press.
2. Holzinger, Machine Learning for Health Informatics, Springer.

Weblinks:

1. https://www.coursera.org/specializations/introduction-to-healthcare-data-analytics?msockid=2d67f50693866b9614a6e34f92e46af0
2. https://www.tangolearn.com/best-healthcare-data-analytics-courses/
3. MGH_Institute: Introduction to Healthcare Data Analysis | edX

QUANTUM COMPUTATIONAL METHODS

Course Code: 2502CS23

L	T	P	C
2	0	1	3

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

CO1: Comprehend the principles of classical vs. quantum computing and various quantum computing hardware implementations
CO2: Demonstrate the operations of quantum gates, understand quantum circuits and their notation, and design quantum circuits for everyday operations
CO3: Explain quantum algorithms and analyzing their time complexity, parallelism, and error correction in quantum computing.
CO4: Apply quantum programming languages and tools.
CO5: Explore quantum applications such as cryptography, machine learning, chemistry simulations, optimization, and ongoing research challenges.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	1	-
CO2	1	2	-	-	1	-
CO3	-	2	2	-	1	-
CO4	1	2	-	-	1	-
CO5	-	-	1	-	1	-

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	1	-
CO3	2	-
CO4	2	-
CO5	1	-

UNIT – I

Overview of classical vs. quantum computing, Quantum superposition, and entanglement (entangled states and their properties, Bell's theorem and the violation of Bell inequalities, Applications of entanglement in quantum information tasks.) Quantum Measurement, Quantum Teleportation, Quantum bits (qubits) and quantum gates, Quantum Computing Hardware, physical implementations of qubits (Superconducting, Trapped Ion, Photonic Qubits).

Practice:

1. Introduction to Qubits and Quantum Gates.
2. Constructing and Simulating Quantum Circuits

UNIT – II

Quantum gates and their operations: Hadamard Gate, Pauli-X Gate, Pauli-Y Gate, Pauli-Z Gate, CNOT Gate, Toffoli Gate, SWAP Gate, Rabi Gate Quantum circuits and circuit diagrams and notation, Quantum circuits for everyday operations.

Practice:

1. Constructing and Simulating Quantum Circuits
2. Quantum Algorithms

UNIT – III

Algorithms: Shor's factoring algorithms, Grover's search algorithm, the adiabatic algorithms, Quantum oracle and its use in Grover's algorithm, Analysing the time complexity of quantum algorithms, Quantum parallelism, Quantum error correction, and its importance.

Practice:

1. Quantum Error Correction

UNIT – IV

Quantum Programming Languages and Tools: Introduction to quantum programming languages (Qiskit, Cirq), Writing simple quantum programs, Debugging and simulating quantum circuits, Accessing and using quantum hardware.

Practice:

1. Quantum Simulation and Measurement

UNIT – V

Quantum Applications, Quantum cryptography, Quantum machine learning, Quantum chemistry and simulations, Quantum optimization, Open problems and ongoing research.

Practice:

1. Quantum Cryptography
2. Quantum Machine Learning

Text Books:

1. Quantum Computation and Quantum Information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press ISBN: 9781107002173
2. Quantum Computing: A Gentle Introduction, Eleanor Rieffel and Wolfgang Polak, MIT Press ISBN: 9780262526678

Reference Books:

1. Programming Quantum Computers, Eric R. Johnston, Nic Harrigan, and Mercedes Gimeno-Segovia, O'Reilly ISBN-10. 1492039683

Web Links:

1. https://nptel.ac.in/courses/106106232/
2. https://learn-xpro.mit.edu/quantum-computing/

TIME SERIES ANALYSIS

Course Code: 2502AI20	L	T	P	C
	2	0	1	3

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

CO1: Understand the fundamentals of time series data, its internal structure, and various forecasting models and processes.
CO2: Analyse and visualize time series data using statistical techniques, transformations, and evaluate forecasting model performance.
CO3: Apply regression techniques to time series data including exponential smoothing, model adequacy checking, and forecasting future values.
CO4: Develop and implement ARMA, ARIMA, and seasonal ARIMA models, and evaluate their effectiveness in forecasting real-world datasets.
CO5: Explore multivariate time series models such as VAR and Vector ARIMA, and understand advanced forecasting approaches using neural networks, spectral and Bayesian analysis.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	-	1
CO2	3	3	2	1	2	1
CO3	2	3	2	1	-	2
CO4	2	3	3	2	1	2
CO5	3	2	2	-	1	1

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	2
CO2	1	1
CO3	2	3
CO4	2	2
CO5	2	2

UNIT-I

Introduction of Timeseries Analysis: Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series. Models for time series analysis, Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting, Forecasting Process, Data for forecasting, Resources for forecasting

Practice:

1. Identify and classify different time series components (trend, seasonality, noise) using real-world datasets such as stock prices or weather data.
2. Compute and interpret Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots for a time series dataset.

UNIT-II

Statistics Background For Forecasting: Graphical Displays, Time Series Plots, Plotting Smoothed Data, Numerical Description of Time Series Data, Use of Data Transformations and Adjustments, General Approach to Time Series Modelling and Forecasting, Evaluating and Monitoring Forecasting Model Performance.

Practice:

1. Generate and interpret time series plots, histograms, and smoothed plots (e.g., using moving average or LOESS) for a given dataset.
2. Apply a Box-Cox transformation to a non-stationary time series and observe the effects on variance stabilization and normality.

UNIT-III

Time Series Regression Model: Introduction Least Squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Prediction of New Observations, Model Adequacy Checking, Variable Selection Methods in Regression, Generalized and Weighted Least Squares, Regression Models for General Time Series Data, Exponential Smoothing, First order and Second order

Practice:

1. Fit a linear regression model on time series data and predict future values; check model adequacy using residual plots.
2. Implement exponential smoothing (single and double) and compare the forecasts with linear regression outputs**.**

UNIT-IV

Autoregressive Integrated Moving Average (Arima)Models: Autoregressive Moving Average (ARMA) Models, Stationarity and Invertibility of ARMA Models, Checking for Stationarity using Variogram, Detecting Nonstationary, Autoregressive Integrated Moving Average (ARIMA) Models, Forecasting using ARIMA, Seasonal Data, Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction, Finding the "BEST" Model.

Practice:

1. Use ADF (Augmented Dickey-Fuller) test to check stationarity, difference the series accordingly, and fit an appropriate ARIMA(p,d,q) model.
2. Model and forecast seasonal data (e.g., monthly sales or temperature) using Seasonal ARIMA and evaluate the forecast accuracy.

UNIT-V

Multivariate Time Series Models And Forecasting: Multivariate Time Series Models and Forecasting, Multivariate Stationary Process, Vector ARIMA Models, Vector AR (VAR) Models, Neural Networks and Forecasting Spectral Analysis, Bayesian Methods in Forecasting.

Practice:

1. Fit a Vector Autoregression (VAR) model on multivariate time series data (e.g., GDP growth and inflation) and analyze interactions.
2. Build a neural network-based time series forecaster (e.g., using LSTM or simple feed-forward NN) and compare its performance with ARIMA.

Text Books:

1 Introduction to Time Series Analysis and Forecasting, 2nd Edition, Wiley Series in Probability and Statistics, By Douglas C. Montgomery, Cheryl L.

2 Master Time Series Data Processing, Visualization, and modelling Using Python Dr. Avishek PalDr. PksPrakash.

Reference Books:

1 Time Series Analysis and Its Applications: With R Examples, Robert H. Shumway and David S. Stoffer, Springer, 4th Edition, ISBN: 978-3-319-52451-1

Web Links:

1 https://www.geeksforgeeks.org/machine-learning/time-series-analysis-and-forecasting/

2 https://onlinecourses.nptel.ac.in/noc21_ch28/preview

RESEARCH METHODOLOGY

Course Code: 2502CE33

L	T	P	C
2	0	0	2

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

CO1: Understand the fundamentals of identifying and formulating a research problem, along with appropriate methods for data collection, analysis, and instrumentation.
CO2: Apply ethical principles in research, conduct effective literature reviews, and develop well-structured research proposals and technical reports.
CO3: Understand the concepts of Intellectual Property (IP), including patents, copyrights, trademarks, and the international scenario of IP protection.
CO4: Analyse patent rights, licensing procedures, technology transfers, and utilize patent databases and information resources.
CO5: Explore recent developments in IPR, including biological systems, software, traditional knowledge, and understand their relevance through case studies.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	2	1	2	2
CO3	2	1	2	1	2	1
CO4	2	2	2	2	1	2
CO5	2	2	2	2	1	3

Mapping Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	2	1
CO4	2	2
CO5	1	2

UNIT–I

Meaning of research problem: Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT–II

Effective literature studies approaches: analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT–III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT–IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications

UNIT–V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1 Research methodology: an introduction for science & engineering students,1st Edition, Stuart Melville, Wayne Goddard.

Reference Books:

1 Research Methodology: A Step-by-Step Guide for beginners, 2nd Edition, Ranjit Kumar.

2 Resisting Intellectual Property, 1st Edition, Halbert, Taylor & Francis Ltd.

Web Links:

1 https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

VALUE EDUCATION

	L	T	P	C
Course Code: 2502CE32	**2**	**0**	**0**	**0**

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

CO 1: Understand value of education and self- development.
CO 2: Explain the need of good values in students.
CO 3: Developing the overall personality.
CO 4: Explain the need of character in a student.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	-	-	2	-
CO2	3	2	1	1	3	-
CO3	3	3	2	2	2	-
CO4	2	1	1	1	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-

UNIT – I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgements.

UNIT – II

Importance of cultivation of values - Sense of duty, Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism. Love for nature, Discipline

UNIT – III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity oflabour, Universal brotherhood and religious tolerance, True friendship

UNIT – IV

Happiness Vs suffering- love for truth, Aware of self- destructive habits, Association and Cooperation, doing best for saving nature.

UNIT – V

Character and Competence –Holy books vs Blind faith, Self-management and Good health, Scienceof reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, mind your Mind, Self-control, Honesty, Studying effectively.

Text Books:

1 Chak ro borty, S.K. "Values and Ethics for organizations Theory and practice", OxfordUniversity Press, New Delhi. (ISBN: 9780195643077)

Reference Books:

1 Value Education and Professional Ethics by R.P. Shukla ISBN: 978-8183560995

2 Value Education: A Textbook for Schools by Dr. N. Venkataiah ISBN: 978-8120731965

3 Value Education: Theory and Practice by G. Rajagopal ISBN: 978-8182475191

Web Links:

1 https://nptel.ac.in/courses/109/104/109104068/

2 https://nptel.ac.in/courses/109/105/109105116/

3 https://nptel.ac.in/courses/109/105/109105116/