MALNAD COLLEGE OF ENGINEERING, HASSAN

Department Of Information Science and Engineering

An Autonomous Institution Affiliated to VTU, Belagavi

Autonomous Programmes

Master of Technology (M.Tech.)

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE (AI & DS)

SYLLABUS

(I, II, III, IV Semester)

Batch 2024-2026

SCHEME OF EVALUATION

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50 % of the maximum marks. Minimum passing marks in SEE is 50 % of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION

1. Two CIE each of 20 Marks will be conducted.
2. Two assignments each of 10 Marks or one Skill Development Activity of 20 marks.
3. The weighted sum of two tests, two assignments/ Skill Development Activities, will be evaluated to 50 marks. CIE methods/ question paper is designed to attain the different levels of as per the outcome defined for the course.

SEMESTER END EXAMINATION

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have six full questions.
3. Each full question is for 20 marks. There will be one full questions (with a maximum of four sub questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions.

Examination	Maximum marks	Minimum marks to qualify
CIE	**50**	**25**
SEE	**50**	**25**

Scheme & Syllabus for I Year

M.Tech. - Artificial Intelligence and Data Science

Academic Year 2024-25

I Semester							
Course	**Course Code**	**Course Title**	**Hours/Week**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
PCC	24SAD11	Data Science and Management	02	00	01	**3**	03
IPCC	24SAD12	Python for Data Sciences	02	00	01	**3**	03
PCC	24SAD13	Artificial Intelligence and Machine Learning	03	02	00	**4**	05
PCC	24SAD14	Deep Learning	02	00	01	**3**	03
PCC	24SAD15	Data Structures and Algorithms for Problem Solving	03	00	00	**3**	03
MCC	24SAD16	Algorithms and AI lab	00	03	00	**2**	03
PCCL	24SAD17	Term Paper 1	00	00	00	**2**	00
Total			**12**	**05**	**03**	**20**	**20**

II Semester							
Course	**Course Code**	**Course Title**	**Hours/Week**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
PCC	24SAD21	Advances DBMS and NoSQL	03	00	00	3	03
PCC	24SAD22	IOT & Applications	02	00	01	3	03
PCC	24SAD23	Data and Web Mining	02	00	01	3	03
PEC	24SAD24X	Professional elective I	03	00	00	3	03
PEC	24SAD25X	Professional elective II	03	00	00	3	03
PCCL	24SAD26	Advanced DBMS & NoSQL Laboratory	00	03	00	2	03
PCCL	24SAD27	Term Paper 2	00	00	00	2	00
AEC	24SAD28	Data Visualization using Python	00	02	00	1	02
Total			**13**	**05**	**02**	**20**	**20**

Professional Elective I		**Professional Elective II**	
Course Code	**Course title**	**Course Code**	**Course title**
24SAD241	Artificial intelligence in Cyber Security	24SAD251	Natural Language Processing
24SAD242	Computer Vision	24SAD252	Big Data Analytics
24SAD243	Cloud Computing	24SAD253	Block Chain Technology
24SAD244	Business Intelligence & Analytics	24SAD254	Pattern Recognition

Scheme & Syllabus for II Year (2024-26 Batch)

M.Tech. - Artificial Intelligence and Data Science

Academic Year 2025-26

III Semester							
Course	**Course Code**	**Course Title**	**Hours/Week**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
PEC	24SAD31	(Online Courses) 12 weeks duration	--	--	--	3	--
PEC	24SAD32	(Online Courses) 12 weeks duration	--	--	--	3	--
PEC	24SAD33	(Online Courses) 12 weeks duration	--	--	--	3	--
INT	24SAD34	Research Internship /Industry-Internship leading to project work/ Startup	Two-semester duration, SEE in the IV semester which leads to project work /start-up			3	03
Total			**00**	**00**	**00**	**12**	**03**

IV Semester							
Course	**Course Code**	**Course Title**	**Hours/Week**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
INT	24SAD41	Research Internship / Industry Internship Leading to Project Work/Start-up	Two Semester Duration			12	--
PRJ	24SAD42	Main Project	00	16	00	16	16
Total			**--**	**--**	**--**	**28**	**16**

INT: Industry/ Research Internship leading to the project work /startup **PRJ:** Project work outcome of Internship (Project Phase-II is Viva voce SEE)

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

Research Internship: A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or

private companies

Research /Industry Internship: In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3rd semester. At the beginning of the 4th semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

Internship Leading to Start-up: An internship that leads to a startup is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching your startup: 1) Maximize your internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentorship 6) Securing Funding 7) Establishing Startup 8) Launching and Marketing. By following these steps, you can effectively transition from an internship to launching a successful startup. This journey requires dedication, resilience, and a willingness to learn and adapt.

Course Title	**Data Science and Management**		
Course Code	**24SAD11**	**L-P- SDA-C**	**2-0-2-3**
Exam	**03 Hours**	**Hours/ Week**	**04**
SEE	**50 Marks**	**Total hours**	**40**

Course objective: To provide students with a comprehensive understanding of data science concepts, techniques, and tools.

Course Outcomes (COs):

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understand the foundational concepts of data science, including its history, significance, and the data science process.	1	
2.	Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets4.	3	
3.	Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.	3	
4.	Utilize data visualization tools and techniques to effectively communicate findings and insights to diverse audiences.		

Course Contents:

Module - 1	8 Hrs.
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model, Introduction to R,.	
Module - 2	**8 Hrs**.
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct(onlinerealestatefirm).ThreeBasicMachineLearningAlgorithms:LinearRegression,k-Nearest Neighbors (kNN),k-means	
Module - 3	**8 Hrs**.
One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web	
Module - 4	**8 Hrs**.

Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and Place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random
Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system
Module - 5 **8 Hrs**
Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists
TEXT BOOKS:
1. Doing Data Science CathyO' Neiland Rachel Schutt, Straight Talk from The Frontline O'Reilly 2014.
2. Mining of Massive Datasets V2.1 Jure Leskovek, Anand Rajaramanand Jeffrey Ullman Cambridge University Press, 2nd Edition 2014.
REFERENCE BOOKS:
1. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Morgan Kauffman, Third Edition, 2012

Course Title	**Python for Data Science**		
Course Code	**24SAD12**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours/ Week**	**04**
SEE	**50 Marks**	**Total hours**	**40**

#	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Understand the fundamentals of Data Science and Database Systems	1, 3	
2.	Explore data analysis, data science process, and Python programs for the algorithms	3	-
3.	Analyze the proficiency in creating data visualizations using tools like Matplotlib and seaborn	1, 3, 12	-
4.	Ability to manipulate, clean and analyze datasets using Python libraries such as Pandas and NumPy.	5	-

Course Contents

Module – 1	8 Hrs.
Introduction: AI, Machine Learning, and Data Science, What is Data Science? Data Science Classification, Data Science Algorithms **Introduction to RDBMS**: Definition and Purpose of RDBMS Key Concepts: Tables, Rows, Columns, and Relationships, Primary Keys, Foreign keys, Unique, Relationships: One-to-One, One-to-Many, Many-to Many. SQL Basics: SELECT, INSERT, UPDATE, DELETE Importance of RDBMS in Data Management for Data Science.	
Module – 2	8 Hrs.
Data Science Process: Prior Knowledge, Data Preparation, Modeling, Application. **Data Exploration:** Objectives of Data Exploration, Datasets, Descriptive Statistics, Data Visualization. Why Python for Data Analysis? Essential Python Libraries, Installation and Setup. **Python Language Basics, IPython, and Jupyter Notebooks:** The Python Interpreter, IPython Basics, Python Language Basics	
Module – 3	8 Hrs.
Built-In Data Structures, Functions, and Files: Data Structures and Sequences, Functions, Files and the Operating System. **NumPy Basics: Arrays and Vectorized Computation:** The NumPy and array: A Multidimensional Array Object, Pseudorandom Number Generation, Universal Functions: Fast Element-Wise ArrayFunctions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra	
Module – 4	8 Hrs.
Getting Started with pandas: Introduction to pandas Data Structures, Essential Functionality,	

Summarizing and Computing Descriptive Statistics. **Data Loading, Storage, and File Formats:** Reading and Writing Data in Text Format, Binary Data Formats, interacting with Web APIs, Interacting with Databases,

Module – 5	**8 Hrs.**
Data Cleaning and Preparation: Handling Missing Data, Data Transformation, Extension Data Types, String Manipulation, Categorical Data. **Plotting and Visualization**: A Brief matplot lib API Primer, Plotting with pandas and sea born,	
Skill Development Activities Suggested The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.	
TEXT BOOKS: 1. "Data-Science-Concepts-and-Practice-2nd-Edition, by Vijay Kotuand, Bala Deshpande, Morgan Kaufmann publisher, Elsevier.(2019)(1.1,1.2,1.4,1.5,2.1,2.2,2.3,2.4, 3.1,3.2,3.3,3.4 2. "Python for Data Analysis" by Wes McKinney, 2nd Edition (2018) (1.2,1.3,1.4, 2.1,2.2,2.3, 3.1,3.2,3.3, 4.1 to 4.6, 5.1 -5.3, 6.1-6.4, 7.1 -7.5, 9.1-9.3)	
REFERENCE BOOKS: 1. "An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Toshigami, 2nd Edition (2021) 2. "The Elements of Statistical Learning" by Trevor Hastie, Robert Toshigami, and Jerome Friedman, 2nd Edition (2009 3. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett, 2nd Edition (2013)	

Course Title	**Artificial Intelligence and Machine Learning**		
Course Code	**24SAD13**	**L-P- SDA-C**	**3-2-0-4**
Exam	**03 Hours**	**Hours/ Week**	**04**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To provide students with a comprehensive understanding of key concepts and techniques in artificial intelligence (AI), problem-solving agents, search strategies, knowledge representation and machine learning.

Course Outcomes (COs):

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze AI problems, design problem-solving agents, and apply search strategies and constraint satisfaction techniques for efficient problem-solving	1, 2, 3, 4	-
2.	Employ advanced search algorithms, apply knowledge representation and reasoning techniques, and design intelligent systems for solving complex AI problems	1, 2, 3, 4	-
3.	Apply machine learning techniques, perform data preparation, and design effective machine learning systems for real-world applications	2,3,5	-
4.	Apply regression, classification, unsupervised learning, and reinforcement learning techniques for solving real-world problems and evaluate their performance	3,5	-

Course Contents:

Module –1	**8 Hrs**.
Introduction: What is AI? **Intelligent Agents**: Agents and environment; Good behavior: The Concept of Rationality; the nature of environment; the structure of agents. **Problem-solving**: Problem-solving agents. Example problems **Uninformed search strategies**: Breadth-first search, Uniform-cost search, Depth-first search, Bidirectional search.	
Module –2	**8 Hrs**.
Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Memory-bounded heuristic search; **Local Search Algorithms and Optimization Problems**: Hill-climbing search Genetic algorithms; **On-line search agents and unknown Environments**: Online search problems, Online search agents, online local search.	
Module – 3	**8 Hrs**.

Learning Problems and Concept Learning: Well Posed learning problems, Designing a Learning systems, Concept Learning Tasks, Search, Find-S, Version Spaces and Candidate Elimination Algorithm, Inductive bias.

Supervised Learning: Introduction, example, classification model, classification learning steps, and Common algorithms –KNN, decision tree.

Module –4	**8 Hrs**.

Supervised Learning: Random forest model, SVM, Regression-Simple linear regression, Multiple linear regressions.

Unsupervised Learning: Supervised Vs Unsupervised, Application, clustering, Finding pattern using Association rule.

Module –5	**8 Hrs**.

Basics of Neural Networks: Exploring the artificial neuron, Types of activation function, Early implementations of ANN, Architectures of NN, Learning process in ANN.

Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Bayesian Belief Networks

Other types of Learning – Representation learning, Active Learning, Instance based Learning, Ensemble learning

TEXT BOOKS:

1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Third edition, Pearson, 2014. .
2. Machine Learning Tom M. Mitchell McGraw-Hill Education (INDIAN EDITION) 2013
3. Machine Learning Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das Pearson 2019

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B Nair, Third edition, McGraw-Hill Education, 2015.
2. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015.
3. Machine Learning, Tom M. Mitchell, McGraw-Hill Science, ISBN: 0070428077.

Course Title	**Deep Learning**		
Course Code	**24SAD14**	**L-P-SDA-C**	**2-0-2-3**
Exam	**03 Hours**	**Hours/ Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To provide students with a comprehensive understanding of deep learning algorithms and techniques, enabling them to apply these methods to solve real-world problems and evaluate their performance using appropriate metrics.

Course Outcomes (Cos):

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understand the basics of Machine Learning	1	-
2.	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.	1, 3	-
3.	Implement deep learning algorithms and solve real-world problems.	1,2	1
4.	Execute performance metrics of Deep Learning Techniques.	1,3	-

Course Contents:

Module – 1	**8 Hrs**.
Machine Learning Basics: Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics,	
Module – 2	**8 Hrs**.
Machine Learning Basics(Conti..): Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning. **Deep Feed forward Networks:** Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation.	
Module – 3	**8 Hrs**.
Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.	
Module – 4	**8 Hrs**.
Convolutional Networks: The Convolution Operation, Motivation, Pooling, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms,	

Module-5	**8 Hrs**

Sequence Modelling: Recurrent and Recursive Nets, Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks.

PRACTICAL COMPONENTS:

#	Experiments
1	Build Machine Learning model to solve real world regression problems.
2	Build Machine learning model to real world binary classification problems.
3	Build simple model to understand overfitting and underfitting conditions.
4	Build simple convolution network to identify hard written character recognition.
5	Analyze performance metrics of the machine learning model.

TEXT BOOKS:

Deep Learning Lan Good fellow and Yoshua Bengio MITPresshttps://www.deeplearningbook.org/ 2016.

REFERENCE BOOKS:

1. Neural Networks: Systematic Introduction Raúl Rojas 1996.
2. Pattern Recognition and machine Learning Chirstopher Bishop 2007.

Course Title	**Data Structures & Algorithms for Problem Solving**		
Course Code	**24SAD15**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course objective: To reduce development time and the resources required to maintain existing application. To increase code reuse and provide a competitive advantage through effective use of data structures and algorithm.

Course Outcomes (Cos):

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply Python syntax and operators, make decisions and implement loops, and effectively write Python code	1, 2, 3, 4, 5, 12	-
2.	Apply Python collections and sequences and create user-defined functions with parameters and optional arguments	1, 2, 3, 4, 5, 12	-
3.	Utilize Python modules effectively, import and explore module attributes, perform file handling operations and utilize file processing functions from the OS module	1, 2, 3, 4, 5, 12	-
4.	Implement object-oriented programming concepts, utilize regular expressions for pattern matching and manipulation, and effectively handle errors and exceptions in Python	1, 2, 3, 4, 5, 12	-

Course Contents:

Module – 1	**8 Hrs**.
Search Trees: Two Models of Search Trees. General Properties and Transformations. Height of a Search Tree. Basic Find, Insert, and Delete. Returning from Leaf to Root. Dealing with Non unique Keys. Queries for the Keys in an Interval. Building Optimal Search Trees. Converting Trees into Lists. Removing a Tree. Balanced Search Trees: Height-Balanced Trees. Weight-Balanced Trees. (a, b)- And B-Trees. Red-Black Trees and Trees of Almost Optimal Height. Top-Down Rebalancing for Red-Black Trees.	
Module – 2	**8Hrs**.
Tree Structures for Sets of Intervals. Interval Trees. Segment Trees. Trees for the Union of Intervals. Trees for Sums of Weighted Interval. Trees for Interval-Restricted Maximum Sum Queries. Orthogonal Range Trees.Higher-DimensionalSegmentTrees.OtherSystemsofBuildingBlocks.Range-CountingandtheSemigroupModel.Kd-TreesandRelatedStructures.	
Module – 3	**8 Hrs**.

Heaps: Balanced Search Trees as Heaps. Array-Based Heaps. Heap-Ordered Trees and Half Ordered Trees. Leftist Heaps. Skew Heaps. Binomial Heaps. Changing Keys in Heaps. Fibonacci Heaps. Heaps of OptimalComplexity.Double-EndedHeapStructuresandMultidimensionalHeaps.Heap-RelatedStructureswithConstant-TimeUpdates.

Module – 4	**8 Hrs**.

Graph Algorithms: Bellman-Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkers on method; Maximum bipartite matching. Polynomials and the FFT : Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

Module – 5	**8 Hrs**

String-Matching Algorithms: Naïve string Matching; Rabin-Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer– Moore algorithms.

Practical Component:

1. Compute the GCD of two numbers.
2. Find the square root of a number. (Newton's method)
3. Exponentiation. (power of a number)
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. Selection sort, Insertion sort.
7. How to create, slice, change, delete and index elements using Tuple.
8. Find First n prime numbers.
9. How to create, slice, change, add, delete and index elements using list.
10. Programs that take command line arguments (word count)
11. Write a program to reverse the string.
12. How to change, delete, add and remove elements in Dictionary.
13. Find the most frequent words in a text read from a file.
14. Simulate elliptical orbits in Pygame.
15. Simulate the bouncing ball using Pygame.

TEXT BOOKS:

1. Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.
2. Kenneth A. Berman. Algorithms. CengageLearning.2002.
3. T. H Cormen, CELeiserson, RL Rivestand C Stein. Introduction to Algorithms. PHI, 3rd Edition, 2010

REFERENCE BOOKS:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4thEdition, 2014,Pearson.
2. Data structures with Java, Ford and Topp, Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S. Rajasekharan. Fundamentals of Computer Universities press.2nd Edition, 2007
4. Data structures and Algorithms in Java, M.T. Goodrich, R. Tomassia, 3rd Edition, WileyIndia Edition.

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

Course Title	**Algorithms and AI Laboratory**		
Course Code	**24SAD16**	**L-P- SDA-C**	**0-3-0-2**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**39**

Course objective: Implement and evaluate algorithm and AI in python programming language

#	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Conduct research independently	2, 4, 12	-
2.	Choose research designs, sampling designs, measurement and scaling techniques, and also different methods of data collections	2, 3, 12	-
3.	Statistically interpret the data and draw inferences	4, 5, 12	-

Course Contents:

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal	
#	
1	Implement a simple linear regression algorithm to predict a continuous target variable based on a given dataset.
2	Develop a program to implement a Support Vector Machine for binary classification. Use a sample dataset and visualize the decision boundary.
3	Develop a simple case-based reasoning system that stores instances of past cases. Implement a retrieval method to find the most similar cases and make predictions based on them.
4	Write a program to demonstrate the ID3 decision tree algorithm using an appropriate dataset for classification.
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test it with suitable datasets.
6	Implement a KNN algorithm for regression tasks instead of classification. Use a small dataset, and predict continuous values based on the average of the nearest neighbours.
7	Create a program that calculates different distance metrics (Euclidean and Manhattan) between two points in a dataset. Allow the user to input two points and display the calculated distances.
8	Implement the k-Nearest Neighbor algorithm to classify the Iris dataset, printing both correct and incorrect predictions.
9	Develop a program to implement the non-parametric Locally Weighted Regression algorithm, fitting data points and visualizing results.
10	Implement a Q-learning algorithm to navigate a simple grid environment, defining the reward structure and analyzing agent performance.

Course Title	**Term Paper 1**		
Course Code	**24SAD17**	**L-P-SDA-C**	**0-0-0-2**
Exam	**03 Hours**	**Hours/ Week**	**-**
CIE	**100 Marks**	**Total hours**	**-**

Course Objective: To provide students with an opportunity to delve into a specific topic within the field of AI and data science, conduct independent research, and demonstrate their understanding and analytical skills.

Course Outcomes (COs) : Students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop advanced research and analytical skills for further study, research, and professional work in the field of artificial intelligence and data science	1, 2, 3, 4, 5, 8, 9, 12	-

Course Contents: The term paper is an integral part of the course and provides students with an opportunity to investigate a specific topic within the discipline. Here are some important considerations regarding Term Paper 1:

- The primary objective of Term Paper 1 is to provide students with the opportunity to conduct autonomous research, delve into a specific area of interest, and demonstrate their comprehension of AI and data science concepts.
- Students are typically permitted to select an AI and data science-related topic that corresponds with their interests and academic objectives. The subject must be well-defined, specific, and pertinent to the course material.
- Students are expected to conduct an exhaustive investigation in order to collect pertinent data, scholarly articles, research papers, and case studies pertinent to their chosen topic. They should evaluate the gathered data critically and draw meaningful conclusions.
- Students are encouraged to demonstrate originality and creativity in their term papers while building on prior knowledge. This may involve proposing new approaches, addressing emerging challenges, or recommending innovative solutions within their selected subject area.
- Depending on the nature of the topic, students may use a variety of research methodologies or examine authentic datasets. It is essential to explicitly describe the methodology employed and justify its selection.

- The term paper should have a distinct introduction, a coherent body, and a succinct conclusion. To improve intelligibility, students should maintain a logical flow and provide appropriate transitions between sections.
- It is essential to properly cite all sources consulted throughout the research process. Students must use the recommended citation style (e.g., APA, MLA) and provide a complete inventory of references at the conclusion of their papers.
- Writing and Presentation Skills: The term paper requires effective communication. Students should ensure that their writing is concise, plain, and error-free. In addition, they may be required to present and defend their term paper, demonstrating their presentation and public speaking skills.
- Throughout the term paper, students must adhere to academic integrity principles. Plagiarism and other forms of intellectual dishonesty are strictly prohibited and carry severe repercussions.
- The term paper will be evaluated based on the faculty's provided criteria. Research profundity, critical analysis, clarity of writing, originality, and adherence to guidelines may be considered when assigning a grade.

SCHEME FOR TERM PAPER 1 EVALUATION

Sl. No.	Particulars	Distribution of Marks
1.	Topic selection, Organization, and Clarity	10
2.	Literature Review and Research Methodology	20
3.	Findings and Analysis	30
4.	Discussion and Conclusion	20
5.	Presentation	20
Total		100

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

II Semester							
Course	**Course Code**	**Course Title**	**Hours**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
PCC	24SAD21	Advances DBMS and NoSQL	03	00	00	3	03
PCC	24SAD22	IOT & Applications	02	00	01	3	03
PCC	24SAD23	Data and Web Mining	02	00	01	3	03
PEC	24SAD24X	Professional elective I	03	00	00	3	03
PEC	24SAD25X	Professional elective II	03	00	00	3	03
PCCL	24SAD26	Advanced DBMS & NoSQL Laboratory	00	03	00	2	03
PCCL	24SAD27	Term Paper 2	00	00	00	2	00
AEC	24SAD28	Data Visualization using Python	00	02	00	1	02
Total			**13**	**05**	**02**	**20**	**20**

Professional Elective I		**Professional Elective II**	
Course Code	**Course title**	**Course Code**	**Course title**
24SAD241	Artificial intelligence in Cyber Security	24SAD251	Natural Language Processing
24SAD242	Computer Vision	24SAD252	Big Data Analytics
24SAD243	Cloud Computing	24SAD253	Block Chain Technology
24SAD244	Business Intelligence & Analytics	24SAD254	Pattern Recognition

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2024 - 26 BATCH SYLLABUS

Course Title	Advanced Database Management System		
Course Code	24SAD21	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course objective: To provide students with a comprehensive understanding of distributed databases, transaction management, object-oriented databases, temporal and spatial databases, deductive databases, active databases and multimedia database systems.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understanding of fundamental Database concepts and apply Normalization techniques to design efficient database schemas.	1,2	1
2.	Analyze distributed database principles, functions of NOSQL databases and big data technologies for handling large scale data with hadoop and map reduce.	2,3	1
3.	Analyze data mining techniques and data warehousing concepts for effective data management and decision making.	2,3	1
4.	Design and implement solutions with map reduce and data models for processing and managing complex data.	3,5,12	2

Course Contents

Module - 1	8 Hrs.
Database System Concepts: Data models, schemas, instance, three schema architecture, data independence, database language, interface, functional dependencies, normal form based on primary key, second normal form, third normal form, Boyce-codd normal formal form, multi-valued dependency and fourth normal form	
Module - 2	**8 Hrs**.
Distributed Database Concepts: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database , Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases, Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems, Distributed Database Architectures, Distributed Catalog Management	
Module - 3	**8 Hrs**.

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. **Big Data Technologies Based on MapReduce and Hadoop**: What Is Big Data? Introduction to Map Reduce and Hadoop, Hadoop Distributed File System (HDFS),
Module - 4 **8 Hrs.**
Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases: Active Database Concepts and Triggers, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Introduction to Deductive Databases
Module - 5 **8 Hrs**
Data Mining: overview of data mining technology, Association rules, Classification, Clustering, Approaches to Other Data Mining Problems, Applications of Data Mining, Commercial Data Mining Tools **Overview of Data Warehousing and OLAP**: Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses.
TEXT BOOKS: 1. Fundamentals of Database Systems, Elmasri and Navathe, Pearson Education, 2013. 2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill 3rd Edition, 2013.
REFERENCE BOOKS: 1. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan McGraw Hill, 6th Edition, 2010.

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2024 - 26 BATCH SYLLABUS

Course Title	Internet of Things and Applications		
Course Code	24SAD22	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course objective: To enable students to understand the fundamentals, its architecture and applications and to design and implement IOT based solutions using modern technologies

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop schemes for the applications of IOT in real time scenarios	1,2,3	
2.	Manage the Internet resources	2	
3.	Model the Internet of things to business	1,2,3	
4.	Work with different case studies with the practical knowledge gained.	4	

Course Contents

Module - 1	8 Hrs.
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation,	
Module - 2	**8 Hrs.**
Automotive Applications, Home Automation, Smart Cards, Tracking, Over. The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications. Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches	
Module - 3	**8 Hrs.**
Constrained Application Protocol, Representational State Transfer, ETSI M2M,,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF Ipv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M,	

Module - 4	**8 Hrs**.
Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity:Ipv6 Technologies for the IoT:,Overview and Motivations. Address Capabilities, Ipv6 Protocol Overview, Ipv6 Tunnelling, Ipsec in Ipv6,Header Compression Schemes,.	
Module - 5	**8 Hrs**
Quality of Service in Ipv6, Migration Strategies to Ipv6 Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.	

TEXT BOOKS:

1. Building the Internet of Things with Ipv6 and MIPv6:The Evolving World of M2M Communications Daniel Minoli Wiley 2013
2. Internet of Things: A Hands-on Approach Arshdeep Bahga, Vijay Madisetti Universities Press 2015

REFERENCE BOOKS:

1. The Internet of Things Michael Miller Pearson 2015 First Edition
2. Designing Connected Products Claire Rowland, Elizabeth Goodman et.al O'Reilly First Edition, 2015.

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2024 - 26 BATCH SYLLABUS

Course Title	Data and Web Mining		
Course Code	24SAD23	L-P- SDA-C	2-0-1-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course Objective: To equip students with the knowledge and skills to analyze, extract and apply meaningful insights from large scale data and web- based resources using modern mining techniques and tools.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Do the pre-processing of dataset	2, 3	
2.	Build data models using various algorithms	2, 3	
3.	Analyze the accuracy of various models with different sample sizes	2	

Course Contents

Module - 1	8 Hrs.
Introduction to Web Data Mining and Data Mining Foundations, Introduction – World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining-Data Mining, Web Mining. Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm- Frequent Item set Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on Prefix Span, Generating Rules from Sequential Patterns.	
Module - 2	**8 Hrs**.
Supervised and Unsupervised Learning Supervised Learning – Basic Concepts, Decision Tree Induction – Learning Algorithm, Impurity Function, Handling of Continuous Attributes, Classifier Evaluation, Rule Induction – Sequential Covering, Rule Learning, Classification Based on Associations, Naïve Bayesian Classification , Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model . Unsupervised Learning – Basic Concepts , K-means Clustering – K-means Algorithm, Representation of Clusters, Hierarchical Clustering – Single link method, Complete link Method, Average link method, Strength and Weakness.	
Module - 3	**8 Hrs**.

Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Methods – Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Preprocessing – Stopword Removal, Stemming, Web Page Preprocessing, Duplicate, Detection, Inverted Index and Its Compression – Inverted Index, Search using Inverted Index, Index Construction, Index Compression, Latent Semantic Indexing – Singular Value

Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.

Module - 4	**8 Hrs**.

Link Analysis and Web Crawling: Link Analysis – Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, Community Discovery-Problem Definition, Bipartite Core Communities, Maximum Flow Communities, Email Communities. Web Crawling – A Basic Crawler Algorithm- Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal, Link Extraction, Spider Traps, Page Repository,

Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.

Module - 5	**8 Hrs**

Opinion Mining and Web Usage Mining Opinion Mining – Sentiment Classification – Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization – Problem Definition, Object feature extraction, Feature Extraction from Pros and Cons of Format1, Feature Extraction from Reviews of Format 2 and 3, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam. Web Usage Mining – Data Collection and Preprocessing- Sources and Types of Data, Key Elements of Web usage Data Preprocessing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web usage Patterns -Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns.

TEXT BOOKS:

1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by Bing Liu (Springer Publications)

REFERENCE BOOKS:

1. Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)
2. Web Mining:: Applications and Techniques by Anthony Scime
3. Mining the Web: Discovering Knowledge from Hypertext Data by Soumen Chakrabarti

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

Course Title	Artificial Intelligence in Cyber Security		
Course Code	24SAD241	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course Objective: To provide students with the knowledge and skills to apply artificial intelligence technique for enhancing threat detection, prevention and response in cyber security.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify cyber threats and limitations of machine learning in security.	1, 3, 4, 7	
2.	Apply machine learning methods to detect anomalies.	1, 2	
3.	Apply feature generation and the theory of network defense.	1,3,5	
4.	Apply supervised learning for abuse problems.	1,2,4	

Course Contents

Module - 1	8 Hrs.
Cyber threats and landscape, The cyber attack's economy, What is Machine learning?, Real-world uses of Machine learning in Security, Spam fighting: an iterative approach, Limitations of machine learning in Security, Training algorithms to learn.	
Module - 2	**8 Hrs.**
Supervised classification algorithms, Practical consideration in classification, Clustering, When to use anomaly detection versus supervised learning, Intrusion detection with Heuristics, data-driven methods, feature engineering for anomaly detection, anomaly detection with data and algorithms, Challenges of using machine learning in anomaly detection.	
Module - 3	**8 Hrs.**
Understanding malware, feature generation, from features to classification, Theory of Network defense, machine learning and network security, building a predictive model to classify network attacks.	
Module - 4	**8 Hrs.**
Monetizing the consumer web, types of abuse and the data that can stop them, Supervised learning for abuse problems, clustering abuse, further direction in clustering, defining machine learning system maturity and scalability.	

Module - 5	**8 Hrs**
Data quality, model quality, performance, maintainability, monitoring and alerting, Security and reliability, feedback and usability.	
TEXT BOOKS: 1. Machine Learning and Securityby Clarence Chio, David Freeman ,Released February 2018 Publisher(s): O'Reilly Media, Inc.	
REFERENCE BOOKS: 1. Hands-On Artificial Intelligence for Cybersecurity by Alessandro Parisi Released August 2019 Publisher(s): Packt Publishing.	

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2024 - 26 BATCH SYLLABUS

Course Title	**Computer Vision**		
Course Code	**24SAD242**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours/ Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To equip students with the knowledge and skills to develop algorithms and applications for analyzing, processing and interpreting visual data from the real word**.**

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Implement fundamental image processing techniques required for computer vision	1,3	
2.	Implement fundamental image processing techniques required for computer vision	1,2	
3.	Implement boundary tracking techniques	1,3	
4.	Apply chain codes and other region descriptors	1,3	
5.	Apply Hough Transform for line, circle, and ellipse detections.	1,2	

Course Contents

Module - 1	**8 Hrs.**
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	
Module - 2	**8 Hrs**.
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	
Module - 3	**8 Hrs**.
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?,	

Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,
Module - 4 **8 Hrs.**
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods:Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.
Module - 5 **8 Hrs**
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.
TEXT BOOKS:
1. Computer Vision – A Modern Approach, David A. Forsyth and Jean Ponce PHI Learning
REFERENCE BOOKS:
1. Computer and Machine Vision – Theory, Algorithms and Practicalities, E. R. Davies Elsevier 4th edition, 2013

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2024 - 26 BATCH SYLLABUS

Course Title	Cloud Computing		
Course Code	24SAD243	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course Objective: To provide students with comprehensive concepts, architectures and services enabling them to design, deploy and manage cloud based solutions effectively.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Compare the strengths and limitations of cloud computing	1,2	
2.	Identify the architecture, infrastructure and delivery models of cloud computing	1,5	
3.	Apply suitable virtualization concept (can be attained through assignments and CIE)	1,5	
4.	Choose the appropriate cloud player	1,4	
5.	Address the core issues of cloud computing such as security, privacy and interoperability (can be attained through assignments and CIE)	2,3	

Course Contents

Module - 1	8 Hrs.
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.	
Module - 2	**8 Hrs**.
Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.	
Module - 3	**8 Hrs**.
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and para virtualization,	

Hardware support for virtualization, Case Study: Xen a VMM based para virtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems

Module - 4	**8 Hrs**.

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start- time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce

applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

Module - 5	**8 Hrs**

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud

based optimal FPGA synthesis .Exercises and problems.

TEXT BOOKS:

1. Cloud Computing Theory and Practice, Dan C Marinescu ,Elsevier(MK) 2013.
2. Computing Principles and Paradigms, RajkumarBuyya , James Broberg, Andrzej Goscinski Willey 2014.

REFERENCE BOOKS:

1. Cloud Computing Implementation, Management and Security, John W Rittinghouse, James F Ransome CRC Press 2013

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2024 - 26 BATCH SYLLABUS

Course Title	Business Intelligence & Analytics		
Course Code	24SAD244	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course Objective: Empower students to analyze data, generate insights and support strategic decision making using advanced tools and methodologies**.**

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the fundamentals of business intelligence and Link data mining with business intelligence.	1	
2.	Apply various modelling techniques. (can be attained through assignment and CIE)	1, 5	
3.	Explain the data analysis and knowledge delivery stages.	3, 5	
4.	Apply business intelligence methods to various situations. (can be attained through assignment and CIE)	5	
5.	Decide on appropriate technique.	1, 3	

Course Contents

Module - 1	8 Hrs.
BUSINESS INTELLIGENCE Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.	
Module - 2	**8 Hrs.**
KNOWLEDGE DELIVERY The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.	
Module - 3	**8 Hrs.**
EFFICIENCY Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis	

Module - 4	**8 Hrs**.
BUSINESS INTELLIGENCE APPLICATIONS Marketing models – Logistic and Production models – Case studies.	
Module - 5	**8 Hrs**
FUTURE OF BUSINESS INTELLIGENCE: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.	

TEXT BOOKS:

1. The Elements of Statistical Learning-Data Mining, Inference, and Prediction Trevor Hastie, Robert Tibshirani, Jerome Friedman Springer 2009.
2. Introduction to Machine Learning, E. Alpaydin PHI 2010.

REFERENCE BOOKS:

1. Pattern Recognition and Machine Learning, Christopher M. Bishop Springer 2007.
2. All of statistics, L.Wasserman Springer 2004.
3. An Introduction to statistical learning with applications in R, G. James, D. Witten, T. Hastie, R. Tibshirani Springer 2017

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2024 - 26 BATCH SYLLABUS

Course Title	**Natural Language Processing**		
Course Code	**24SAD251**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours/ Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To enable students to develop systems and algorithms that understand, interpret and generate human language for various real world applications.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze the natural language text.	1,2	
2.	Generate the natural language.	4,10	
3.	Demonstrate Text mining.	3, 5	

Course Contents

Module - 1	**8 Hrs.**
OVERVIEW AND LANGUAGE MODELLING: Overview: Origins and challenges of NLP-Language and Grammar- Processing Indian Languages- NLP Applications-Information Retrieval. Language Modelling: Various Grammar- based Language Models-Statistical Language Model.	
Module - 2	**8 Hrs**.
WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions-FiniteState Automata- Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing Probabilistic Parsing.	
Module - 3	**8 Hrs**.
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.	
Module - 4	**8 Hrs**.

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.

Module - 5	**8 Hrs**

INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical

Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

TEXT BOOKS:

1. Natural Language Processing and Information Retrieval, TanveerSiddiqui, U.S. Tiwary, Oxford University Press, 2008.
2. Natural LanguageProcessing andText Mining. Anne Kao and Stephen R. Potee, Springer-Verlag London Limited. 2007.

REFERENCE BOOKS:

1. Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition. Daniel Jurafsky and James H Martin. Prentice Hall, 2008 2nd Edition.
2. Natural Language Understandin.James Allen. Benjamin/Cumming spublishing company, 2nd edition, 1995.
3. Information Storage and Retrieval systems. Gerald J. Kowalski and Mark.T. Maybury. Kluwer academic Publishers, 2000.
4. Natural Language Processing with Python.Steven Bird, Ewan Klein, Edward Loper. O'Reilly Media, 2009.

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

Course Title	**Big Data Analytics**		
Course Code	**24SAD252**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours/ Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To equip students with the skills to analyze, interpret and derive insights from large, complex datasets using advanced tools and techniques for informed decision making.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Figure out concepts of managing big data using Hadoop and SPARK technologies	1, 12	
2.	Explain HDFS and MapReduce concepts	1, 3	
3.	Install, configure, and run Hadoop and HDFS	1, 3, 5	
4.	Perform map-reduce analytics using Hadoop and related tools (can be attainedthrough assignments and CIE)	1, 5	
	Explain SPARK concepts (can be attained through assignments and CIE)	1, 5	

Course Contents:

Module - 1	**8 Hrs.**
Meet Hadoop: Data!, Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals MapReduce: A Weather Dataset: Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming The Hadoop Distributed File systemThe Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, HadoopFilesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow: Anatomy of a File Read, Anatomy of a File Write.	
Module - 2	**8 Hrs**.

YARN Anatomy of a YARN Application Run: Resource Requests, Application Lifespan, Building YARN Applications, YARN Compared to MapReduce, Scheduling in YARN: The FIFO Scheduler, The Capacity Scheduler, The Fair Scheduler, Delay Scheduling, Dominant Resource Fairness. Hadoop I/O Data Integrity, Data Integrity in HDFS, Local File System, Checksum File System, Compression, Codecs, Compression and Input Splits, Using Compression in Map Reduce, Serialization, The Writable Interface, Writable Classes, Implementing a Custom Writable, Serialization Frameworks, File-Based Data Structures: Sequence File
Module - 3 **8 Hrs.**
Developing a Map Reduce Application The Configuration API, Combining Resources, Variable Expansion, Setting Up the Development Environment, Managing Configuration, Generic Options Parser, Tool, and Tool Runner, Writing a Unit Test with MRUnit: Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The Map Reduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Tuning a Job, Profiling Tasks, Map Reduce Workflows: Decomposing a Problem into Map Reduce Jobs, Job Control, Apache Oozie How Map Reduce Works Anatomy of a Map Reduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures: Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort: The Map Side, The Reduce Side, Configuration Tuning, Task Execution: The Task Execution Environment, Speculative Execution, Output Committers.
Module - 4 **8 Hrs.**
Map Reduce Types and Formats: Map Reduce Types, Input Formats: Input Splits and Records, Text Input, Binary Input, Multiple Inputs, Database Input (and Output) Output Formats: Text Output, Binary Output, Multiple Outputs, Lazy Output, Database Output, Flume Installing Flume, An Example, Transactions and Reliability, Batching, The HDFS Sink, Partitioning and Interceptors, File Formats, Fan Out, Delivery Guarantees, Replicating and Multiplexing Selectors, Distribution: Agent Tiers, Delivery Guarantees, Sink Groups, Integrating Flume with Applications, Component Catalog.
Module - 5 **9 Hrs**
Pig Installing and Running Pig, Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example: Generating Examples, Comparison with Databases, Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Data Processing Operators: Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data. Spark An Example: Spark Applications, Jobs, Stages and Tasks, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization,

Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution, Executors and Cluster Managers: Spark on YARN

TEXT BOOKS:

1. Hadoop: The Definitive Guide ,Tom White, O'Reilley 3rd Edition, 2012.
2. SPARK: The Definitive Guide, Bill Chambers MateiZaharia, O'Reilley 2018.

REFERENCE BOOKS:

1. Apache Flume: Distributed Log Collection for Hadoop, D'Souza and SteveHoffman O'Reilley 2014.

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

Course Title	Block chain Technology		
Course Code	24SAD253	L-P- SDA-C	3-0-0-3
Exam	03 Hours	Hours/ Week	03
SEE	50 Marks	Total hours	40

Course objective: To explore the Block Chain technology, its applications and ability to develop decentralized applications using Block Chain frameworks.

Course Outcomes (COs): Students shall be able

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Interpret the types, benefits and limitation of block chain.	2,4,7	-
2.	Explore the block chain decentralization and cryptography concept.	1,4	-
3.	Enumerate the Bitcoin features and its alternative options.	2,10	-

Course Contents

Module - 1	8 Hrs.
Block chain 101: Distributed systems, History of block chain, Introduction to block chain, Types of block chain, CAP theorem and block chain, Benefits and limitations of block chain.	
Module - 2	**8 Hrs.**
Decentralization and Cryptography: Decentralization using block chain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys	
Module - 3	**8 Hrs.**
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Block chain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	
Module - 4	**8 Hrs.**
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum block chain, Elements of the Ethereum block chain, Precompiled contracts.	
Module - 5	**8 Hrs**
Alternative Block Chains: Block chains Block chain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media	

TEXT BOOKS:

1. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

REFERENCE BOOKS:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
2. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

Course Title	**Pattern Recognition**		
Course Code	**24SAD254**	**L-P- SDA-C**	**3-0-0-3**
Exam	**03 Hours**	**Hours/ Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To equip students with the knowledge and techniques to identify patterns in data through statistical, machine learning and computational methods for real-world applications

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Choose algorithms for Pattern Recognition.	3,5	
2.	Analyse decision tress.	2,3	
3.	Design the nearest neighbour classifier.	5	

Course Contents

Module - 1	**8 Hrs.**
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems	
Module - 2	**8 Hrs.**
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation	
Module - 3	**8 Hrs.**
Nearest Neighbour based classifiers & Bayes classifier: Nearest neighbour algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network	
Module - 4	**8 Hrs.**
Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, Over fitting & Pruning, Examples , Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM	

Module - 5	**8 Hrs**
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, kmeans, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition	

TEXT BOOKS:

1. Pattern Recognition (An Introduction,. V Susheela Devi, M Narsimha Murthy, Universities press, 2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost , PH, 1996.

REFERENCE BOOKS:

1. Pattern Classification, Duda R. O., P.E. Hart, D.G. Stork, John Wiley and sons, 2000.

Course Title	**Advance DBMS & NoSQL Laboratory**		
Course Code	**24SAD26**	**L-P- SDA-C**	**0-3-0-2**
Exam	**02 Hours**	**Hours/ Week**	**3**
SEE	**50 Marks**	**Total hours**	**39**

Course Objective: Enable students to implement theoretical concepts of database management systems in practical scenarios.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Create database objects.	3	
2.	Design entity-relationship diagrams to solve given database applications.	3	
3.	Formulate SQL queries in Oracle for the given problem.	3, 5	
4.	Implement a database schema for a given problem.	3, 5	
	Apply normalization techniques to improve the database design for the given problem.	2, 3	
	Build database and verify for its appropriate normalization for any given problem	3	

Course Contents

	Experiments
1	Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries. BRANCH (Branchid, Branchname, HOD) STUDENT (USN, Name, Address, Branchid, sem) BOOK (Bookid, Bookname, Authorid, Publisher, Branchid) AUTHOR (Authorid, Authorname, Country, age) BORROW (USN, Bookid, Borrowed_Date) Execute the following Queries: i.List the details of Students who are all studying in 2nd sem MCA. ii.List the students who are not borrowed any books. iii. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2ndsem MCA Students who borrowed books. iv. Display the number of books written by each Author. v. Display the student details who borrowed more

	than two books. vi. Display the student details who borrowed books of more than one Author. vii. Display the Book names in descending order of their names. viii. List the details of students who borrowed the books which are all published by the same publisher.
2	Consider the following schema: STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA) Execute the following queries: i. Update the column total by adding the columns mark1, mark2, mark3. ii. Find the GPA score of all the students. iii. Find the students who born on a particular year of birth from the date_of_birth column. iv. List the students who are studying in a particular branch of study. v. Find the maximum GPA score of the student branch-wise. vi. Find the students whose name starts with the alphabet "S". vii. Find the students whose name ends with the alphabets "AR". viii. Delete the student details whose USN is given as 1001
3	Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries. Consider a Cricket Tournament "ABC CUP" organized by an organization. In the tournament there are many teams are contesting each having a Teamid,Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers,age. A player represents only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having a stadium_name,Address (involves city,area_name,pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_the match award given to a player. Execute the following Queries: i. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament. ii. List the details of the stadium where the maximum number of matches were played. iii. List the details of the player who is not a captain but got the man_of _match award

	at least in two matches. iv. Display the Team details who won the maximum matches. v. Display the team name where all its won matches played in the same stadium.
4	A country wants to conduct an election for the parliament. A country having many constituencies. Each constituency is identified uniquely by Constituency_id, having the Name, belongs to a state,Number_of_voters. A constituency can have many voters. Each voter is uniquely identified by using Voter_id, having the Name, age, address (involves Houseno,city,state,pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidates are uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party.Thereare many parties. Each party is uniquely identified by using Party_id, having Party_Name,Party_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituencty. Queries: 1. List the details of the candidates who are contesting from more than one constituenc 2. ies which arebelongs to different states. 2. .Display the state name having maximum number of constituencies. 3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg". 4. Create a stored procedure to display the number_of_voters in the specified constituency. Where the constituency name is passed as an argument to the stored procedure. 5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.
5	Design an ER-diagram for the following scenario, Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries. A country can have many Tourist places. Each Tourist place is identified by using tourist_place_id, having a name, belongs to a state, Number of kilometers away from the 02.03.2021 updated 52/ 104 capital city of that state,history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist_id, having a

	Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates. Queries: i. List the state name which is having maximum number of tourist places. ii. List details of Tourist place where maximum number of tourists visited. iii. List the details of tourists visited all tourist places of the state "KARNATAKA". iv. Display the details of the tourists visited at least one tourist place of the state, but visited all states touristplaces. v. Display the details of the tourist place visited by the tourists of all country.

Course Title	**Term Paper - 2**		
Course Code	**24SAD27**	**L-P- SDA-C**	**0-2-0-2**
Exam	**03 Hours**	**Hours/ Week**	**--**
SEE	**100 Marks**	**Total hours**	**--**

Course Objective: To provide students with an opportunity to delve into a specific topic withinthe field of AI and data science, conduct independent research, and demonstrate their understanding and analytical skills.

Course Outcomes (Cos), students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop advanced research and analytical skills for further study, research, and professional work in the field of artificial intelligence and data science	1, 2, 3, 4, 5, 8, 9, 12	-

The term paper is an integral part of the course and provides students with an opportunity to investigate a specific topic within the discipline. Here are some important considerations regarding Term Paper 1:

- The primary objective of Term Paper 1 is to provide students with the opportunity to conduct autonomous research, delve into a specific area of interest, and demonstrate their comprehension of AI and data science concepts.
- Students are typically permitted to select an AI and data science-related topic that corresponds with their interests and academic objectives. The subject must be well-defined, specific, and pertinent to the course material.
- Students are expected to conduct an exhaustive investigation in order to collect pertinent data, scholarly articles, research papers, and case studies pertinent to their chosen topic. They should evaluate the gathered data critically and draw meaningful conclusions.
- Students are encouraged to demonstrate originality and creativity in their term papers while building on prior knowledge. This may involve proposing new approaches, addressing emerging challenges, or recommending innovative solutions within their selected subject area.
- Depending on the nature of the topic, students may use a variety of research methodologies or examine authentic datasets. It is essential to explicitly describe the methodology employed and justify its selection.
- The term paper should have a distinct introduction, a coherent body, and a succinct conclusion. To improve intelligibility, students should maintain a logical flow and provide appropriate transitions between sections.

- It is essential to properly cite all sources consulted throughout the research process. Students must use the recommended citation style (e.g., APA, MLA) and provide a complete inventory of references at the conclusion of their papers.
- Writing and Presentation Skills: The term paper requires effective communication. Students should ensure that their writing is concise, plain, and error-free. In addition, they may be required to present and defend their term paper, demonstrating their presentation and public speaking skills.
- Throughout the term paper, students must adhere to academic integrity principles. Plagiarism and other forms of intellectual dishonesty are strictly prohibited and carry severe repercussions.
- The term paper will be evaluated based on the faculty's provided criteria. Research profundity, critical analysis, clarity of writing, originality, and adherence to guidelines may be considered when assigning a grade.

SCHEME FOR TERM PAPER 1
EVALUATION

Sl. No.	Particulars	Distribution of Marks
1.	Topic selection, Organization, and Clarity	10
2.	Literature Review and Research Methodology	20
3.	Findings and Analysis	30
4.	Discussion and Conclusion	20
5.	Presentation	20
	Total	100

Course Title	**Data Visualization using Python**		
Course Code	**24SAD28**	**L-P- SDA-C**	**0-2-0-1**
Exam	**02 Hours**	**Hours/ Week**	**02**
SEE	**50 Marks**	**Total hours**	**26**

Course objective: The course aims to equip students with fundamental skills in data visualization using Python, utilizing libraries such as Matplotlib, Seaborn, Bokeh, and Plotly. Students will develop the ability to create various visualizations, analyze and interpret data, and apply these skills to support decision-making processes.

Course Outcomes (COs): Students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate the use of IDLE or PyCharm IDE to create Python Applications	5	-
2.	Utilize Python libraries (Matplotlib, Seaborn, Bokeh, and Plotly) to create a variety of visualizations, analyze and interpret data to derive meaningful insights, and support decision-making.	2,3,5	1
3.	Use Python programming constructs to develop programs for solving real- world problems.	3	-

Experiments	
1.	a. Write a python program to find the best of two test average marks out of three test's marks accepted from the user. b. Develop a Python program to check whether a given number is palindrome or not and count the number of occurrences of each digit in the input number.
2.	a. Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. b. Develop a python program to convert binary to decimal, octal to hexadecimal using functions.
3.	a. Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. b. Write a Python program to find the string similarity between two given strings
4.	Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib. Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.
5.	Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib. Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.
6.	Write a Python program to illustrate Linear Plotting using Matplotlib. Write a Python program to illustrate liner plotting with line formatting using Matplotlib.
7.	Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions.

8.	a. Write a Python program to explain working with bokeh line graph using Annotations and Legends. Write a Python program for plotting different types of plots using Bokeh.
9	Write a Python program to draw 3D Plots using Plotly Libraries.
10.	Write a Python program to draw Time Series using Plotly Libraries. Write a Python program for creating Maps using Plotly Libraries.

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Lab Test	Two tests are conducted, with a 60% weightage for experiment and 40% for viva-voce, averaged and scaled to 20 marks.	**20**
Continuous Evaluation	Each experiment is evaluated for conduction, observation, and write-up, with neatness and timely submission considered. The record is evaluated out of 10 marks per experiment, scaled to 30 marks.	**30**
Total		**50**

MASTER OF TECHNOLOGY - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

2024 - 26 BATCH SYLLABUS

III Semester							
Course	**Course Code**	**Course Title**	**Credits**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
PEC	24SAD31	(Online Courses) 12 weeks duration	--	--	--	3	--
PEC	24SAD32	(Online Courses) 12 weeks duration	--	--	--	3	--
PEC	24SAD33	(Online Courses) 12 weeks duration	--	--	--	3	--
INT	24SAD34	Research Internship /Industry-Internship leading to project work/ Startup	Two-semester duration, SEE in the IV semester which leads to project work /start-up			3	03
Total			**00**	**00**	**00**	**12**	**03**

IV Semester							
Course	**Course Code**	**Course Title**	**Credits**			**Total Credits**	**Total Contact Hours**
			L	P	SDA		
INT	24SAD41	Research Internship / Industry Internship Leading to Project Work/Start-up	Two Semester Duration			12	--
PRJ	24SAD42	Main Project	00	16	00	16	16
Total			**--**	**16**	**--**	**28**	**16**

INT: Industry/ Research Internship leading to the project work /startup **PRJ:** Project work outcome of Internship (Project Phase-II is Viva voce SEE)

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

Research Internship: A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

Research /Industry Internship: In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3rd semester. At the beginning of the 4th semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

Internship Leading to Start-up: An internship that leads to a startup is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching your startup: 1) Maximize your internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentorship 6) Securing Funding 7) Establishing Startup 8) Launching and Marketing. By following these steps, you can effectively transition from an internship to launching a successful startup. This journey requires dedication, resilience, and a willingness to learn and adapt.

Course Title	**(Online Courses) 12 weeks duration**		
Course Code	**21SAD31, 21SAD32 and 21SAD33**	**Credits**	**03**

a) Courses (prescribed in respective program) to be completed from first semester to Third semester, the student has to complete the online courses as notified by the department, offered by NPTEL and complete the courses irrespective of the number of attempts with final score (Online Assignments: 25% and Final Exam:75%) leading to NPTEL Elite(60 to 75%)/Elite + Silver (76 to 89%)/Elite + Gold (> = 90%).

b) The student shall be permitted to drop the registered coursework & select alternative coursework in case they do not appear for the proctored exam or do not complete the proctored exam.

c) The Department shall announce the BoS approved list of MOOC Courses corresponding to each program. The department shall have the freedom to review and approve additional online courses from time to time.

d) The student shall choose the number of online courses with credits summing up to 9 credits from the list of approved online courses.

Course Title	**MAIN PROJECT**		
Course Code	**24SAD44**	**L-P- SDA-C**	**0-16-0-16**
Exam	**3 Hrs**	**Hours / Week**	**-**
SEE	**100 Marks**	**CIE**	**100 Marks**

MAIN PROJECT:

Each student of the project batch shall be involved in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. Follow the Software Development life cycle Data Collection, Planning, Design the Test cases Validation and verification of attained results. Significance of parameters w.r.t scientific quantified data. Publish the project work in referred Journal/conferences(UGC/SCOPUS/WoS)

Continuous Internal Evaluation:

SCHEME FOR EVALUATION

Sl. No.	**Particulars**	**Distribution of Marks**
1.	Project Report	30
2.	Paper publication	30
3.	Project Demonstration & Presentation	30
4.	Question and Answer	10
Total		100

Note: Plagiarism check shall be carried out for Project report using Turn-it-in with less than 25% similarity and Drill-bit with less than 10% similarity index.

Semester End Evaluation:

SCHEME FOR EVALUATION

Sl. No.	**Particulars**	**Distribution of Marks**
1.	Project Report	30
2.	Procedure Writing	15
3.	Project Demonstration & Presentation	40
4.	Question and Answer	15
Total		100