SREENIVASAINSTITUTEOFTECHNOLOGYANDMANAGEMENTSTUDIES
(Autonomous)

Minor - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING - Offered by CSM Department

S.No	Course Code	CourseTitle	Scheme of Instructions HoursperWeek				Scheme ofExaminationMaximumMarks		
			L	T	P	C	I	E	Total
1	23MRAIM1	Introduction to Artificial Intelligence	3	-	-	3	30	70	100
2	23MRAIM2	Machine Learning Fundamentals	3	-	-	3	30	70	100
3	23MRAIM3	Deep Learning & Neural Networks	3	-	-	3	30	70	100
4	23MRAIM4	Natural Language Processing	3	-	-	3	30	70	100
5	23MRAIM5	Computer Vision	3	-	-	3	30	70	100
6	23MRAIM6	AI & ML Lab	-	-	3	1.5	30	70	100
7	23MRAIM7	NLP & Computer Vision Lab	-	-	3	1.5	30	70	100

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CSM Department

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

23MRAIM1	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the fundamental concepts and historical evolution of Artificial Intelligence.
- Learn various problem-solving approaches using AI algorithms.
- Gain insights into knowledge representation, reasoning, and planning techniques.
- Explore basic machine learning and neural network models.
- Familiarize with real-world AI applications and ethical implications.

UNIT –1: Introduction to Artificial Intelligence: (9)

Definition and applications of AI- History and evolution of AI- Intelligent agents – types and environments- AI techniques: Symbolic AI- Sub-symbolic AI

UNIT –2: Problem Solving and Search Strategies (9)

Problem formulation- Uninformed search: BFS- DFS- Uniform Cost- Informed search: Greedy- A* search- Local search: Hill climbing- Simulated annealing- Constraint satisfaction problems

UNIT –3: Knowledge Representation and Reasoning (9)

Propositional and First-Order Logic- Forward and backward chaining- Rule-based systems and ontologies- Semantic networks- frames- Uncertainty: Bayesian reasoning- fuzzy logic

UNIT –4: Machine Learning Basics (9)

Overview of supervised- unsupervised- reinforcement learning- Decision Trees- k-NN- Naïve Bayes- Basic concepts of neural networks and perceptron- Training and testing datasets- Evaluation metrics: Accuracy- precision- recall- F1-score

UNIT –5: Applications of AI and Ethical Issues (9)

AI in Robotics- NLP- Vision- Healthcare- Finance- Chatbots and virtual assistants- AI biases- fairness- explainability- Social and legal implications of AI- Future trends: AGI- ethical AI

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course- students will be able to		Bloom's Level
CO1	Explain the foundational principles and history of AI.	Understand (L2)
CO2	Apply AI techniques for problem-solving and decision-making.	Apply (L3)
CO3	Analyze search strategies and knowledge representation models.	Analyze (L4)
CO4	Evaluate the effectiveness of learning algorithms and intelligent agents.	Evaluate (L5)
CO5	Design simple AI-based systems or prototypes using AI concepts.	Create (L6)

TEXT BOOKS:

1. **Stuart Russell & Peter Norvig,** Artificial Intelligence: A Modern Approach, 4th Edition, Pearson
2. **Elaine Rich, Kevin Knight,** Artificial Intelligence, 3rd Edition, McGraw-Hill
3. **Dan W. Patterson,** Introduction to Artificial Intelligence and Expert Systems, PHI

REFERENCE BOOKS:

1. **Kevin Murphy**, *Machine Learning: A Probabilistic Perspective*, MIT Press
2. **Nils J. Nilsson**, *The Quest for Artificial Intelligence*, Cambridge
3. **Tom Mitchell**, *Machine Learning*, McGraw-Hill

REFERENCE WEBSITE:

1. ***CourseraAIFor Everyone*** *– Andrew Ng*

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23MRAIM2	MACHINE LEARNING FUNDAMENTALS	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand core concepts of supervised, unsupervised, and reinforcement learning.
- Learn foundational algorithms for classification, regression, and clustering.
- Analyze model performance using evaluation metrics and tuning methods.
- Gain practical knowledge in implementing ML models using datasets.
- Understand the mathematical and probabilistic foundations of ML algorithms.

UNIT –1: Introduction to Machine Learning: (9)

Definition and Scope of ML, Types of Learning: Supervised, Unsupervised, Reinforcement, Basic Terminology: Instance, Feature, Label, Training and Testing Sets, Applications and Challenges, Python Libraries: scikit-learn, pandas, numpy

UNIT –2: Supervised Learning – Regression & Classification (9)

Linear Regression, Polynomial Regression, Logistic Regression, k-Nearest Neighbors (k-NN), Decision Trees and Random Forests, Naïve Bayes Classifier

UNIT –3: Unsupervised Learning & Dimensionality Reduction (9)

k-Means Clustering, Hierarchical Clustering, Principal Component Analysis (PCA), t-SNE, Autoencoders (Intro Only). Association Rule Mining,

UNIT –4: Model Evaluation and Tuning (9)

Confusion Matrix, Precision, Recall, F1-Score, ROC-AUC, Bias-Variance Tradeoff, Cross-Validation, Hyperparameter Tuning: Grid Search & Random Search, Overfitting&Underfitting

UNIT –5: Advanced Topics & Real-time Applications (9)

Introduction to Neural Networks (Perceptron), Introduction to SVMs, Feature Engineering & Selection, Real-world Use Cases: Spam Detection, Credit Scoring, Medical Diagnosis, Ethical AI and Model Explainability (XAI – Intro Only)

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course- students will be able to		**Bloom's Level**
CO1	Understand the concepts and assumptions behind key ML algorithms.	Understand (L2)
CO2	Apply various supervised and unsupervised learning techniques.	Apply (L3)
CO3	Analyze the strengths and limitations of different machine learning models.	Analyze (L4)
CO4	Evaluate model performance using metrics and validation techniques.	Evaluate (L5)
CO5	Design and implement complete ML solutions for real-world problems.	Create (L6)

TEXT BOOKS:

1. **Tom M. Mitchell,** Machine Learning, McGraw-Hill, 1997**.**

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23MRAIM3	DEEP LEARNING & NEURAL NETWORKS	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the fundamentals of deep learning and neural networks.
- Analyze and implement feedforward, convolutional, and recurrent neural networks.
- Learn key optimization techniques and regularization methods.
- Explore architectures like CNN, RNN, LSTM for various applications.
- Apply deep learning models to real-world problems in vision, NLP, and speech..

UNIT –1: Introduction to Deep Learning: (9)

Basics of machine learning and need for deep learning- Biological and artificial neurons- Activation functions: Sigmoid- Tanh- ReLU- Leaky ReLU- Perceptron and Multi-Layer Perceptron (MLP)- Backpropagation algorithm

UNIT –2: Optimization and Regularization (9)

Cost functions: Cross-entropy- MSE- Gradient descent- SGD- Momentum- RMSProp- Adam- Overfitting and underfitting- Regularization: L1- L2- Dropout- Batch Normalization- Weight initialization techniques

UNIT –3: Convolutional Neural Networks (CNN) (9)

Convolution operation- filters- feature maps- Pooling layers- padding- stride- CNN architectures: LeNet- AlexNet- VGGNet- ResNet- Applications in image classification and object detection.

UNIT –4: Recurrent Neural Networks (RNNs) and LSTMs (9)

Sequence modeling basics- RNN architecture and backpropagation through time- Vanishing/exploding gradient problems- Long Short-Term Memory (LSTM) and GRU- Applications: Text generation- machine translation- time-series

UNIT –5: Generative Models and Applications (9)

Autoencoders and VariationalAutoencoders (VAE)- Generative Adversarial Networks (GANs)- Transfer learning and pre-trained models- Deep learning applications in vision- NLP- healthcare- Deployment consideration (TensorFlowLite, ONNX, etc.)

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course- students will be able to		**Bloom's Level**
CO1	Explain the structure and working of deep neural networks.	Understand (L2)
CO2	Analyze the learning process and optimization strategies in deep learning.	Analyze (L4)
CO3	Apply CNNs and RNNs to practical problems like image and sequence processing.	Apply (L3)
CO4	Evaluate the performance of models using loss functions and regularization.	Evaluate (L5)
CO5	Design and implement deep learning models using modern frameworks.	Create (L6)

TEXT BOOKS:

1. **Ian Goodfellow, YoshuaBengio, Aaron Courville – Deep Learning, MIT Press**
2. **François Chollet – Deep Learning with Python, Manning Publications**
3. **Josh Patterson & Adam Gibson – Deep Learning: A Practitioner's Approach, O'Reilly**

REFERENCE BOOKS:

1. **Michael Nielsen – Neural Networks and Deep Learning (online free book)**
2. **Nikhil Buduma – Fundamentals of Deep Learning, O'Reilly**
3. **Simon Haykin – Neural Networks and Learning Machines, Pearson**

REFERENCE WEBSITE:

Platform	**Course Title & Link**
Coursera	Deep Learning Specialization – Andrew Ng

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23MRAIM4	NATURAL LANGUAGE PROCESSING (NLP)	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the foundational concepts of NLP and linguistics.
- Explore text preprocessing and linguistic analysis techniques.
- Apply NLP techniques for syntactic and semantic analysis.
- Utilize NLP tools for information retrieval, summarization, and sentiment analysis.
- Design and build machine learning and deep learning models for NLP applications.

UNIT –1: Introduction to NLP & Linguistics: (9)

NLP tasks and applications. Components of NLP: Morphology- syntax- semantics- pragmatics- Linguistic essentials: POS tagging- Lemmatization- Stemming- Languagemodeling: N-grams- Smoothing techniques- Perplexity

UNIT –2: Text Processing & Feature Engineering: (9)

Text preprocessing: Tokenization- normalization- stopword removal- Feature extraction: Bag of Words- TF-IDF- Word embeddings (Word2Vec- GloVe)- Dimensionality reduction: PCA- LSA

UNIT –3: Syntax & Parsing Techniques: (9)

POS tagging algorithms: Rule-based- HMM- CRF- Syntax trees and dependency parsing- Context-Free Grammars (CFG)- CYK algorithm

UNIT –4: Semantics & Discourse Processing (9)

Named Entity Recognition (NER).Word Sense Disambiguation (WSD).Semantic similarity and clustering. Sentiment analysis and emotion detection

UNIT –5: NLP with Machine Learning & Deep Learning: (9)

Text classification using Naïve Bayes- SVM- RNN- LSTM- GRU for sequence modelling- Transformer-based models (BERT- GPT)- Applications: Chatbots- Translation- Summarization

Total Hours: 45

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COURSE OUTCOMES:

On successful completion of the course- students will be able to		**Bloom's Level**
CO1	Understand language structure and basic NLP pipeline.	Understand (L2)
CO2	Apply text processing and feature extraction techniques.	Apply (L3)
CO3	Analyze syntactic and semantic structures using NLP tools.	Analyze (L4)
CO4	Evaluate NLP models and select suitable algorithms for various tasks.	Evaluate (L5)
CO5	Design NLP-based solutions using ML/DL models for real-world applications.	Create (L6)

TEXT BOOKS:

1. **Daniel Jurafsky and James H. Martin** – *Speech and Language Processing*, Pearson
2. **Steven Bird, Ewan Klein, Edward Loper** – *Natural Language Processing with Python*, O'Reilly
3. **Yoav Goldberg** – *Neural Network Methods in NLP*, Morgan & Claypool

REFERENCE BOOKS:

1. **Jacob Eisenstein** – *Introduction to Natural Language Processing*, MIT Press
2. **Chris Manning** – Stanford NLP resources (online)
3. **Allen &Unwin** – *Foundations of Statistical Natural Language Processing*

REFERENCE WEBSITE:

1. **Coursera-Natural Language Processing Specialization – DeepLearning.AI**

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23MRAIM5	COMPUTER VISION	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Understand the fundamentals of image formation, representation, and basic processing.
- Explore key concepts of feature detection, segmentation, and motion tracking.
- Apply machine learning and deep learning techniques in visual recognition tasks.
- Analyze real-time applications of computer vision in various domains.
- Implement and evaluate computer vision algorithms using Python/OpenCV frameworks.

UNIT –1: Fundamentals of Computer Vision: (9)

Introduction to computer vision and image formation- Camera models: pinhole- orthographic- perspective- Digital images: pixels- intensity- channels- color spaces (RGB- HSV- YCbCr)- Basic image operations: filtering- edge detection (Sobel- Canny)

UNIT –2: Image Processing and Feature Detection: (9)

Histograms- thresholding- contrast adjustment- Convolution- Gaussian smoothing- Laplacian- Feature detection: corners (Harris- FAST)- blobs (LoG- DoG)- edges- SIFT- SURF- ORB for local features

UNIT –3: Image Segmentation and Object Recognition: (9)

Region-based segmentation: region growing- split and merge- Clustering: K-means- Mean-shift- Morphological operations- Object detection: Haar cascades- HOG + SVM- Viola-Jones

UNIT –4 Motion Analysis and 3D Vision: (9)

Optical flow: Horn-Schunck- Lucas-Kanade- Background subtraction- moving object detection- Structure from Motion (SfM)- Stereo vision- depth estimation

UNIT –5 Deep Learning in Computer Vision: **(9)**

Introduction to CNNs (Convolutional Neural Networks)- Architectures: LeNet- AlexNet- VGG- ResNet- Object detection using YOLO- SSD- Faster R-CNN- Image segmentation using U-Net- Mask R-CNN- Applications: face recognition- self-driving cars- surveillance

Total Hours: 45

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COURSE OUTCOMES:

On successful completion of the course- students will be able to		**Bloom's Level**
CO1	Understand the principles of digital image formation and transformation.	Understand (L2)
CO2	Apply computer vision algorithms for image enhancement and feature extraction.	Apply (L3)
CO3	Analyze object recognition, detection, and classification techniques.	Analyze (L4)
CO4	Evaluate deep learning models for vision tasks like segmentation and tracking.	Evaluate (L5)
CO5	Design and implement real-world computer vision applications.	Create (L6)

TEXT BOOKS:

1. **Richard Szeliski** – *Computer Vision: Algorithms and Applications*, Springer
2. **Gonzalez & Woods** – *Digital Image Processing*, Pearson
3. **Simon Prince** – *Computer Vision: Models, Learning, and Inference*, Cambridge University Press

REFERENCE BOOKS:

1. **Gary Bradski& Adrian Kaehler** – *Learning OpenCV*, O'Reilly
2. **David Forsyth & Jean Ponce** – *Computer Vision: A Modern Approach*, Pearson
3. **Ian Goodfellow et al.** – *Deep Learning*, MIT Press (for Unit V)

REFERENCE WEBSITE:

. Coursera- Computer Vision Specialization – University of Michigan

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23MRAIA6	AI & ML LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

- To understand core AI and ML techniques.
- To implement models using Python libraries.

Experiments:

1. Introduction to AI/ML libraries: NumPy, Pandas
2. Supervised vs Unsupervised Learning demo
3. Linear Regression implementation
4. Decision Tree Classifier
5. Naive Bayes Classifier
6. K-Means Clustering
7. SVM classifier
8. Hyperparameter tuning
9. Model evaluation techniques
10. Deployment with Flask API (demo)
11. Model saving and loading using pickle

Course Outcomes:

- Develop supervised and unsupervised ML models.
- Evaluate model performance using metrics.

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23MRAIA7	NLP & COMPUTER VISION LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

- To implement basic NLP and CV pipelines.
- To work with image and text datasets.

Experiments:

1. Text preprocessing (tokenization, stemming, etc.)
2. Bag of Words and TF-IDF models
3. Text classification using Logistic Regression
4. Named Entity Recognition (NER)
5. Sentiment Analysis
6. Image reading and manipulation using OpenCV
7. Image filtering and transformations
8. Face detection using Haar cascades
9. CNN model using TensorFlow/Keras
10. Image classification with pre-trained models
11. Text-to-Image and Image Captioning (intro)

Course Outcomes:

- Build NLP pipelines (tokenization to classification).
- Perform image preprocessing and recognition.