

Branch Name:	MCA
Program Code:	CS201
Course Code	4CS2010308T
Course Title	Deep Learning
Pre-requisite Course:	It is essential to have a solid foundation in programming, mathematics and basic machine learning concepts.

Course Objective:

1. To understand the fundamental concepts of neural networks and deep learning architectures.
2. To apply training and optimization techniques for building efficient deep learning models.
3. To analyze and implement deep learning models for image and sequence data using CNNs and RNN-based architectures.
4. To explore modern deep learning approaches including attention mechanisms, transformer-based models, and Large Language Models (LLMs).
5. To evaluate advanced deep learning techniques such as Generative AI, Autoencoders, and GANs, along with their real-world applications and ethical considerations.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	-	3	60	40	-	-	100

Course Content			
Unit No	Topics	Total Hours	Weightage (%)
1	Foundations oFundamentals of Deep Learning • AI, ML, and Deep Learning overview • Artificial Neuron, Perceptron • Multi-Layer Perceptron (MLP) • Feedforward Neural Networks • Activation Functions (ReLU, Sigmoid, Softmax) • Loss Functions (basic idea)	05	15
2	Training Deep Training of Deep Neural Networks • Gradient Descent (Batch, Stochastic, Mini-batch) • Backpropagation (working concept) • Optimization Algorithms (Adam, RMSProp) • Regularization (Dropout, Batch Normalization) • Hyperparameter Tuning • Model Evaluation Metrics	07	20

3	Convolutional Convolutional Neural Networks (CNN) • CNN Architecture and Concepts • Convolution, Padding, Stride • Pooling Layers • Basic Architectures (LeNet, AlexNet – overview) • Applications: • Image Classification • Intro to Object Detection	08	20
4	Sequence ModSequence Models, Transformers & LLMs • RNN (basic idea & limitations) • LSTM and GRU • Word Embeddings (overview) • Attention Mechanism • Transformer Architecture (Self-Attention concept) • Introduction to Large Language Models (LLMs) ◦ Overview of: GPT, BERT ◦ Applications: Chatbots, Text & Code Generation	08	20
5	Advanced Deep Learning & Generative AI • Autoencoders and VAE (concept) • Generative Adversarial Networks (GANs) • Transfer Learning & Fine-Tuning • Foundation Models (overview) • Explainable AI (XAI) • Ethical Issues in AI (bias, privacy)	08	25

Text Book

- Goodfellow, I., Bengio, Y., & Courville, A., Deep Learning, MIT Press, 2016.

Reference Books

1. Chollet, F., Deep Learning with Python, 2nd Edition, Manning Publications, 2021.
2. Géron, A., Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, 2022.
3. Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J., Dive into Deep Learning, Cambridge University Press, 2023.
4. Tunstall, L., von Werra, L., & Wolf, T., Natural Language Processing with Transformers, O'Reilly Media, 2022.

Optional (For Advanced Learning / Latest Trends)

5. Raschka, S., Liu, Y., & Mirjalili, V., Machine Learning with PyTorch and Scikit-Learn, Packt Publishing, 2022.
6. Foster, D., Generative Deep Learning, 2nd Edition, O'Reilly Media, 2023.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain basic deep learning concepts and architectures	2.Understand
CLO2	Apply training and optimization techniques	3.Apply
CLO3	Analyze CNN models for vision tasks	4.Analyze
CLO4	Apply sequence models and transformer-based NLP techniques	3.Apply
CLO5	Evaluate advanced DL models including LLMs and Generative AI	5.Evaluate

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H	M	-	-	L	-	L	-	-	-	-	-	L	-
CLO2	H	H	M	M	M	-	L	-	-	-	-	-	M	L
CLO3	H	H	H	M	M	-	L	-	-	-	L	L	M	L
CLO4	H	H	H	M	M	-	L	-	-	L	L	M	H	M
CLO5	H	H	H	H	M	L	M	L	L	L	M	M	H	H

H:High, M:Medium, L:Low