	SRINIVASA INSTITUTE OF ENGINEERING AND TECHNOLOGY **(UGC – Autonomous Institution)** (Approved by AICTE, Permanently affiliated to JNTUK, Kakinada, ISO 9001: 2015 certified Institution) (Accredited by NAAC with 'A' Grade; Recognised by UGC under sections 2(f) & 12(B)) NH-216, Amalapuram-Kakinada Highway, Cheyyeru (V), AMALAPURAM -533216.	**DEEP LEARNING**	A.Y: 2024-25
		YEAR: III	SEMESTER: II

COURSE SCHEDULE – AT A GLANCE

Name of the Faculty : K VIJAY BABU

Name of the Course : DEEP LEARNING

Course Code : :21P61602

Branch : AIML

The Schedule for the whole Course is: 23/12/2024 To 26/04/2025

Unit	Description	Duration (Date)		Total No. of Periods
		From	To	
1	Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modelling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, Fundamentals of Machine Learning: Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting	24/12/2024	21/01/2025	14
2	Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks.	22/01/2025	12/02/2025	17
3	Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification.	13/02/2025	11/03/2025	14
4	Convolutional Neural Networks: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation, Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch.	12/03/2025	03/04/2025	17
5	Interactive Applications of Deep Learning: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. Deep Learning Research: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks.	04/04/2025	25/04/2025	16

Total No. of Instructional periods available for the course: 78

LESSON PLAN

COURSE: DEEP LEARNING

Unit No.	Topic	Plan		Actual		Teaching Methodology	Signature of the faculty
		No of hours	Date	No of hours	Date		
UINIT-1	**Introduction to Deep Learning** Overview of artificial intelligence (AI) How deep learning fits within AI	1	24/12/24			Chalk & Talk	
	History of Machine Learning Early developments and key milestones Evolution of machine learning techniques over time	1	26/12/24			Chalk & Talk	
	Probabilistic Modelling in Machine Learning Introduction to probabilistic models Importance of probability in machine learning	1	27/12/24			Chalk & Talk	
	Early Neural Networks Development of early neural networks (e.g., perceptron, multi-layer perceptron) Limitations of early models	1	31/12/24			Chalk & Talk	
	Kernel Methods in Machine Learning Understanding kernel methods and their significance and Popular algorithms using kernel methods (e.g., Support Vector Machines)	1	02/01/24			Chalk & Talk	
	Decision Trees Basic structure and working of decision trees And How decision trees are used in machine learning	1	03/01/24			Chalk & Talk	
	Random Forests Introduction to random forests and how they improve upon decision trees and their advantages	1	07/01/25			Chalk & Talk	
	Gradient Boosting Machines (GBM) Overview of boosting techniques Introduction to gradient boosting and its applications **Fundamentals of Machine Learning** The four primary branches of machine learning: supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning and How each branch is applied in various contexts	2	08/01/25			Chalk & Talk	

	Supervised Learning Explanation of supervised learning techniques and Examples of algorithms: Linear Regression, SVM, Neural Networks	1	09/01/25			Chalk & Talk	
	Unsupervised Learning Introduction to unsupervised learning methods and Key algorithms like K-means, hierarchical clustering, and PCA	1	10/01/25			Chalk & Talk	
	Evaluating Machine Learning Models Importance of evaluation metrics (e.g., accuracy, precision, recall, F1 score) and Cross-validation and other evaluation techniques	1	16/01/25			PPT	
	Overfitting in Machine Learning What is overfitting and how it occurs and Methods to prevent overfitting (e.g., regularization, dropout)	1	17/01/25			Chalk & Talk	
	Underfitting in Machine Learning What is underfitting and its causes and Techniques to address underfitting (e.g., increasing model complexity)	1	21/01/25			Chalk & Talk	
UNIT-2	**Introduction to Deep Learning** Overview of deep learning and its significance in AI and Differences between deep learning and traditional machine learning **Biological Vision: Human Perception** How human vision works biologically Key features of the human visual system	2	22/01/25			Chalk & Talk	
	Machine Vision : How machines interpret and process images and The role of computer vision in deep learning	1	23/01/25			Chalk & Talk	
	Linking Biological Vision to Machine Vision: Comparison between human vision and machine vision and How deep learning models attempt to mimic biological vision	1	24/01/25			PPT	
	Introduction to Human Language Processing Basics of human language understanding How humans process and understand language	1	28/01/25			Chalk & Talk	
	Human vs. Machine Language Differences between human language processing and machine language processing How machine learning models handle language data **Overview of Artificial Neural Networks (ANNs)**	2	29/01/25			Chalk & Talk	

	Basic structure of ANNs and Neurons, layers, and activation functions						
	Types of Neural Networks Different types of neural networks (e.g., feedforward, convolutional, recurrent) and How each type is suited for specific tasks	1	30/01/25			Chalk & Talk	
	Training Neural Networks Basics of training a neural network (backpropagation and gradient descent) and Importance of training data and labels	1	31/01/25			Chalk & Talk	
	Activation Functions in Neural Networks Role of activation functions in neural networks and Popular activation functions (e.g., sigmoid, ReLU, tanh)	1	04/02/25			PPT	
	Loss Functions in Deep Learning Introduction to loss functions (e.g., mean squared error, cross-entropy) and How loss functions influence model training **Optimizing Deep Networks** Optimization algorithms (e.g., stochastic gradient descent, Adam) and How optimization improves model performance	2	05/02/25			Chalk & Talk	
	Overcoming Challenges in Training Deep Networks Common challenges (e.g., vanishing gradients, overfitting) and Techniques to overcome these challenges (e.g., normalization, dropout)	1	06/02/25			Chalk & Talk	
	Improving Deep Networks: Regularization Techniques Introduction to regularization methods (e.g., L1/L2 regularization, dropout) and How regularization helps in improving model generalization	1	07/02/25			Chalk & Talk	
	Improving Deep Networks: Batch Normalization : Role of batch normalization in speeding up training and How it helps in stabilizing deep network training	1	11/02/25			Chalk & Talk	
	Improving Deep Networks: Data Augmentation Overview of data augmentation techniques and How augmenting data improves model robustness and generalization **Fine-Tuning Deep Networks** Fine-tuning pre-trained models and Techniques for transfer learning and its advantages	2	12/02/25			Chalk & Talk	

UNIT-3	**Introduction to Neural Networks** Overview of neural networks and their role in machine learning and Basic principles and applications of neural networks	1	13/02/25			Chalk & Talk	
	Anatomy of a Neural Network Components of a neural network: neurons, layers, weights, and biases and How data flows through a neural network and the role of activation functions	1	14/02/25			PPT	
	Types of Neural Networks Overview of different types of neural networks: feedforward, convolutional, recurrent and Use cases and differences in architecture	1	18/02/25			Chalk & Talk	
	Introduction to Keras Overview of Keras and its role as a high-level neural network API and Key features and advantages of Keras for building deep learning models **Introduction to TensorFlow** Overview of TensorFlow and its ecosystem for deep learning and Key features and why it's popular in production environments	2	19/02/25			Chalk & Talk	
	Introduction to Theano Overview of Theano and its role in deep learning and Differences between Theano and TensorFlow	1	20/02/25			Chalk & Talk	
	Introduction to CNTK (Microsoft Cognitive Toolkit) Overview of CNTK and its advantages for deep learning tasks and Key differences between CNTK, TensorFlow, and Keras	1	21/02/25			Chalk & Talk	
	Setting up a Deep Learning Workstation Step-by-step guide to setting up the hardware and software for deep learning and installing essential tools (e.g., Python, TensorFlow, Keras, GPU setup)	1	25/02/25			Chalk & Talk	
	Introduction to Binary Classification What binary classification is and how it is used in machine learning and Examples and real-world applications of binary classification	1	04/03/25			Chalk & Talk	
	Classifying Movie Reviews: Binary Classification Example Step-by-step guide to classifying movie reviews as positive or negative using neural networks and preprocessing the data and implementing a binary classification model	2	05/03/25			PPT	

	Introduction to Multiclass Classification What multiclass classification is and how it differs from binary classification and Common techniques for multiclass classification						
	Classifying Newswires: Multiclass Classification Example Step-by-step guide to classifying news articles into categories using neural networks and Data preprocessing, model creation, and evaluation for multiclass classification	1	06/03/25			Chalk & Talk	
	Evaluating Binary Classification Models Metrics for evaluating binary classification models (e.g., accuracy, precision, recall, F1-score) and how to assess the performance of a binary classification model	1	07/03/25			Chalk & Talk	
	Evaluating Multiclass Classification Models Metrics for evaluating multiclass classification models (e.g., confusion matrix, accuracy, precision, recall) and how to assess the performance of a multiclass classification model	1	11/03/25			Chalk & Talk	
UNIT-4	**Introduction to Convolutional Neural Networks (CNNs)** Overview of CNNs and their significance in deep learning and Key applications of CNNs in image recognition, computer vision, etc **Neural Networks and Representation Learning** Understanding how neural networks learn representations of data and The role of neural networks in feature extraction	2	12/03/25			Chalk & Talk	
	Convolutional Layers in CNNs Explanation of convolutional layers and their function and How convolutions help extract spatial features from images	1	13/03/25			Chalk & Talk	
	Activation Functions in CNNs Overview of activation functions commonly used in CNNs (e.g., ReLU, Sigmoid) and How activation functions affect the learning process in CNNs	1	18/03/25			Chalk & Talk	
	Pooling Layers in CNNs Understanding max pooling and average pooling layers and The purpose of pooling in CNNs to reduce spatial dimensions	2	19/03/25			Chalk & Talk	

	Fully Connected Layers in CNNs The role of fully connected layers after convolutional layers and How they help in classification tasks						
	Multichannel Convolution Operation Understanding how convolution operations work on multiple channels (e.g., RGB channels) and How multichannel convolution captures different features	1	20/03/25			Chalk & Talk	
	Understanding Feature Maps in CNNs Explanation of feature maps produced by convolution layers and The role of feature maps in detecting patterns	1	21/03/25			Chalk & Talk	
	Introduction to Recurrent Neural Networks (RNNs) Overview of RNNs and their differences from traditional feedforward networks and Key applications of RNNs in sequence data, such as text and time-series analysis	1	25/03/25			PPT	
	The Working Mechanism of RNNs How RNNs process sequential data using hidden states and Explanation of vanishing gradients problem in RNNs **Building an RNN Model: Code Example** Step-by-step guide to implementing a simple RNN model using code and Explanation of the code structure and model training	2	26/03/25			Chalk & Talk	
	Introduction to PyTorch Tensors Understanding tensors and their importance in deep learning and How PyTorch uses tensors for storing and manipulating data	1	27/03/25			Chalk & Talk	
	Deep Learning with PyTorch Introduction to PyTorch as a deep learning framework and Key features and advantages of using PyTorch for building models	1	28/03/25			Chalk & Talk	
	PyTorch Basics: Autograd and Optimization Understanding PyTorch's autograd feature for automatic differentiation and Introduction to optimization in PyTorch, including the use of optimizers like SGD	1	01/04/25			Chalk & Talk	
	Building Neural Networks in PyTorch Step-by-step guide to creating a simple neural network model using PyTorch and Explanation of model layers, forward passes, and backward passes	2	02/04/25			Chalk & Talk	

	Convolutional Neural Networks in PyTorch Implementing CNNs using PyTorch and Practical code example for building and training a CNN in PyTorch						
	Training and Evaluating CNNs in PyTorch Guide to training a CNN model in PyTorch and Techniques for evaluating the performance of CNNs (e.g., accuracy, loss, confusion matrix)	1	03/04/25			PPT	
UNIT-5	**Introduction to Interactive Applications of Deep Learning** Overview of deep learning's applications in real-world interactive systems and Key areas of impact: machine vision, natural language processing, reinforcement learning	1	04/04/25			Chalk & Talk	
	Machine Vision in Deep Learning Applications of deep learning in computer vision and How deep learning models are used for image recognition, object detection, and scene segmentation	1	08/04/25			Chalk & Talk	
	Object Detection and Classification with Deep Learning Deep learning models for detecting and classifying objects within images and Common techniques: Convolutional Neural Networks (CNNs) for image processing **Natural Language Processing (NLP) with Deep Learning** Overview of NLP and its use in deep learning models and Common NLP tasks: sentiment analysis, machine translation, text summarization	2	09/04/25			Chalk & Talk	
	Speech Recognition and Deep Learning Deep learning techniques for speech recognition and Applications in voice assistants, transcription, and audio analysis	1	10/04/25			Chalk & Talk	
	Generative Adversarial Networks (GANs) Introduction to GANs and their architecture (generator vs discriminator) and Applications of GANs in image generation, art creation, and data augmentation	1	11/04/25			Chalk & Talk	
	Applications of GANs in Deep Learning Practical applications of GANs, such as generating realistic images, videos, and synthetic data and Use of GANs in entertainment, gaming, and simulation	1	15/04/25			Chalk & Talk	

	Introduction to Deep Reinforcement Learning (DRL) Overview of reinforcement learning and its connection to deep learning and How DRL models learn through interaction with an environment to maximize rewards **Deep Q-Learning in DRL** Explanation of Q-learning in reinforcement learning and How deep Q-networks (DQNs) are used to solve complex decision-making tasks	2	16/04/25			Chalk & Talk	
	Applications of Deep Reinforcement Learning Use cases of DRL in robotics, autonomous driving, and gaming (e.g., AlphaGo) and Benefits of DRL for real-time, interactive decision-making systems	1	15/04/25			Chalk & Talk	
	Introduction to Deep Learning Research Key research areas in deep learning and emerging trends and Overview of deep learning's contributions to AI and new frontiers in research	1	18/04/25			Chalk & Talk	
	Autoencoders in Deep Learning Introduction to autoencoders and their role in unsupervised learning and how autoencoders are used for data compression, anomaly detection, and feature learning	1	22/04/25			Chalk & Talk	
	Deep Generative Models Overview Introduction to generative models and their role in deep learning and how deep generative models aim to model the underlying distribution of data **Boltzmann Machines** Introduction to Boltzmann Machines and their architecture and Use of Boltzmann Machines in unsupervised learning and pattern recognition	2	23/04/25			Chalk & Talk	
	Restricted Boltzmann Machines (RBMs) Explanation of RBMs and their application in feature extraction and dimensionality reduction and Differences between Boltzmann Machines and RBMs	1	24/04/25			Chalk & Talk	
	Deep Belief Networks (DBNs) Overview of DBNs and their layered structure for generative learning and How DBNs combine the advantages of both unsupervised and supervised learning	1	25/04/25			Chalk & Talk	

Text Books:

1. Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications,ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821

Reference Books:

1. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc.,ISBN: 9781492041412
2. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
3. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013 4. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

Faculty **HOD** **Dean-Academics** **Principal**