EC406: Deep Learning

Details of course :-

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Deep learning	3	1	0	Calculus, Linear Algebra, and some notions of Machine Learning

Course Objective: To make students understand the basic concepts and significance and the context of neural networks and deep learning. Understand the data needs of deep learning. Have a working knowledge of neural networks and deep learning. Analyze and differentiate between different types of deep learning approaches.

Course Outcomes:
CO1: Explain the fundamental concepts of Deep Learning, including various Neural Networks for supervised and unsupervised learning.
CO2: Build, train, and deploy different types of Deep Architectures, including Convolutional Networks, Recurrent Networks, and Autoencoders.
CO3: Identify the deep learning algorithms that are more appropriate for various types of learning tasks in various domains.
CO4: Build deep learning models in TensorFlow and interpret the results.
CO5: Implement deep learning algorithms and solve real-world problems.

S. No.	Content	Contact Hours
Unit 1	Introduction to Deep Learning: History of Deep Learning, Types of errors, Bias-variance trade-off, Overfitting-underfitting, Brief review of concepts from Vector Calculus, andOptimization, Gradient Descent, Variants of Gradient Descent, Momentum, Computation graph, Vectorization, and Broadcasting.	4
Unit 2	Neural Networks Basics: Basic concepts of Artificial Neurons, Single and Multi-layer Perceptrons, Feed Forward NN, Backpropagation, and Different activation functions-Sigmoid, ReLU, Hyperbolic, and Softmax. Softmax cross-entropy loss function, BinaryClassification, Logistic Regression, LogisticRegression Cost Function.Shallow neural networks: Neural Network Representation, Gradient descent for NeuralNetworks, Backpropagation, Random Initialization.Training a network: Loss functions, Stochastic gradient descent, AdaGrad,	8

	RMSProp, and Adam.	
Unit 3	Deep Neural Networks: Deep L-layer neural network, Forward Propagation in a DeepNetwork, Building blocks of deep neural networks, Parameters vs Hyperparameters.Improving Deep Neural Networks: Hyperparameter tuning, Regularization, Dropout,Batchnorm, and Optimization.Autoencoders, Variational Autoencoders (VAEs), Regularization in autoencoders, Denoising autoencoders, and Sparse autoencoders.	8
Unit 4	Recurrent Neural Networks: Recurrent Neural Network Model, Different types of RNNs, Gated Recurrent Units (GRUs), Long short-term memory (LSTM), Encoder-Decoder architectures, Bidirectional RNN, Deep RNNs, Deep Reinforcement Learning, Embeddings & Word2vec, Sentiment Prediction RNN.	6
Unit 5	Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behindCNNs, Multiple Filters, CNN applications, Foundations of Convolutional NeuralNetworks, Convolution, and Pooling Operation.Siamese Network, Transfer Learning.ConvNet Architectures: AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet,MobileNet-v1, etc.Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.	8
Unit 6	Deep generative models: Generative Adversarial Networks (GANs), Attacking neuralnetworks with Adversarial Examples and Generative Adversarial Networks, DeepConvolutional GANs, Conditional GAN, Super-Resolution GAN, CycleGAN, PIX2PIXGAN, etc.,Deep Learning Applications: Face recognition and verification, Natural LanguageProcessing, Speech Recognition, Video Analytics, Neural Style Transfer, AI and Healthcare, Detection, Segmentation, Image, and video captioning.	8
	Total	42

Books:-

S. No	Name of Books/Authors/Publisher
1	Artificial Neural Networks/Yegnanarayana, B/PHI Learning Pvt. Ltd. 2009
2	Deep Learning/Goodfellow, I., Bengio, Y., and Courville, A./MIT Press 2016