Course Code CSA4004	Deep Learning	Course Type	LT
		Credits	3

Course Objectives :

- Gain knowledge in Machine Learning Basics
- Understand and apply Optimization on Deep Models and Networks
- Understand and analyze Recurrent and Recursive Networks
- Understand the representation of neural networks in machine learning.

Course Outcomes:

Students who complete this course will be able to

- Analyze Deep learning Mathematical Models
- Explore the Basic fundamentals of Machine Learning Algorithms
- Elucidate the Deep Feedforward Networks
- Apply knowledge for Optimization on Deep Models and Convolutional Networks
- Elucidate the Recurrent and Recursive Networks and Natural language Processing

Student Outcomes (SO) : a, b, c, g, l

Module No.	Module Description	Hrs.	SO
1	**UNIT I INTRODUCTION** Introduction : Historical Trends in Deep Learning -Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms – Eigen decomposition - Probability and Information Theory: Random variable and distributed Probability - Bayes Rule -Information Theory and structured probabilistic models.	6	a, b
2	**UNIT II MACHINE LEARNING** **Numerical Computation:** Overflow and Underflow - Gradient based Optimization – Constrained Optimization - **Learning Algorithms**: Capacity - Overfitting - Under fitting - Bayesian Classification -Supervised - unsupervised algorithms - Building machine learning algorithm.	6	a, g
3	**UNIT III ADVANCED NEURAL NETWORKS** Deep Feed forward Networks : Gradient based learning - Hidden Units - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustes –Semi supervised learning -Multitask learning - Adserial training.	6	a, b
4	**UNIT IV OPTIMIZATION ON DEEP MODELS** Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms -Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms -Convolutional Networks: Motivation - Structured Output - Unsupervised features -Neuroscientific basics for Convolutional Networks.	6	b, g
5	**UNIT V RECURRENT AND RECURSIVE NETWORKS** Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks - Echo State Networks - Practical Methodology Applications: Large Scale Deep Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.	6	a, l
6	**Guest Lecture on Contemporary Topics**	2	
	Total	30	

Mode of Teaching and Learning:
Flipped Class Room, Activity Based Teaching/Learning, Digital/Computer based models, wherever possible to augment lecture for practice/tutorial and minimum 2 hours lectures by industry experts on contemporary topics

Mode of Evaluation:
The assessment and evaluation components may consist of unannounced open book examinations, quizzes, student's portfolio generation and assessment, and any other innovative assessment practices followed by faculty, in addition to the Continuous Assessment Tests and Term End Examination.

Text Book(s):

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Reference Book(s):

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
2. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.
3. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995. .

Recommendation by the Board of Studies on	17.01.2020
Approval by Academic council on	20.01.2020
Compiled by	Dr S Sountharrajan