CSEN3081	DEEP LEARNING	L	T	P	S	J	C
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Pre-requisite	CSEN3011:Artificial Neural Networks						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course is designed to introduce modern techniques of neural networks and deep learning, which have revolutionized machine learning and artificial intelligence practice to graduate students. Deep Learning continues to fascinate us with its endless possibilities in self-driving cars and virtual assistants like Alexa, Siri, and Google Assistant. This course aims to cover the basics of Deep Learning and some of the underlying theory with a particular focus on supervised Deep Learning along with a good coverage of unsupervised methods.

Course Educational Objectives:

- To summarize neural networks and regularization techniques.
- To familiarize Convolution Neural Networks and its architecture.
- To learn Recurrent Neural network architecture and its effectiveness
- To illustrate deep unsupervised learning techniques
- To inspect Deep neural network architecture in real time applications

UNIT 1 **Deep Feed Forward Networks, Gradient descent, Back propagation, Regularization techniques** **9 hours**

Parameter Norm Penalties, Norm penalties as constrained optimization.

UNIT 2 **Convolution Network** **9 hours**

Architectures, Convolution operations, Pooling layer, Variants of the basic Convolution Function, Efficient Convolution algorithms, Random and unsupervised features, Neuro Scientific Basis for Convolutional Networks

UNIT 3 **Sequence Modelling** **9 hours**

RNN, Encoder and decoder archerites, DRN, Recursive Neural Networks, LSTM and other G RNN, GRU

UNIT 4 Auto encoders and Deep generative models 9 hours

Auto encoders: Under complete auto encoders, regularized encoders, stochastic encoders and decoders

Deep generative models: Boltzmann Machines, restricted Boltzmann machines, Deep Belief networks, Deep Boltzmann machines for real world data

UNIT 5 Applications of Deep Learning 9 hours

Large scale Deep learning, Computer vision, speech recognition, NLP, other applications. Introduction to Generative Adversarial Networks(GANs) and its applications

Textbooks:

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

Additional Reading

Reference Books:

1. Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Deep Learning, First Edition, Pearson
2. Sandro Skansi, Introduction to Deep Learning, Springer

Coursera Courses:

1. https://www.coursera.org/learn/neural-networks-deep-learning/home/welcome
2. https://www.coursera.org/learn/introduction-to-deep-learning-with-keras
3. https://www.coursera.org/learn/convolutional-neural-networks
4. https://www.coursera.org/learn/nlp-sequence-models?specialization=deep-learning (Week-1)

Course Outcomes: After successful completion of the course the student will be able to:

1. Illustrate the role of neural networks and its various applications.

2. Design the architecture of CNN

3. Apply the RNN architecture and its effectiveness for a real world applications

4. Investigate auto encoders techniques in deep learning.

5. Analyse the applications of Deep Learning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1												
CO2	1	2	2	2											
CO3	2	1	2	1											
CO4	2	1	1	1											
CO5	1	1	2	2											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 06-09-2021 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:
SDGs: 3, 9

SDG Justification:

SDG:3 Good Health and Well-being

Statement: The potential of Deep Learning for better equity, access, and the development of real-time public health solutions. It allow everyone and everywhere access to personalized medicine which is effective, respects the biological, cultural and behavioral differences between people, respects privacy & other ethical requirements and affordable

SDG:9 Industry, Innovation and Infrastructure

Statement: The holistic understanding of Deep Learning has led to develop various new models like CNN, RNN, RCNN, and GANs for achieving outstanding results on several complex cognitive tasks, matching or even beating those provided by human performance