

## **Subject: Deep Learning (703DB0C016)**

Lecture	Date	Topics	Hours
	<i>Chapter 1</i>	<i>Introduction to Deep Learning</i>	4
1	17-07-2022	About deep learning, Perceptron, Activation Functions, Perceptron examples, Multi-output Perceptron, Single Layer and Deep/Dense Neural Network, Loss Function, Gradient Descent, Backpropagation, Learning Rates, and Regularization	4
		<u>Lab Work 1:</u> <ul style="list-style-type: none"> <li>Perceptron in Tensorflow</li> <li>Iris using Dense Neural Network</li> </ul>	
		<u>Assignment 1:</u> <ul style="list-style-type: none"> <li>Estimate first iteration of single neural network with two variables</li> <li>Designing DNN to identify financial risk</li> </ul>	
	<i>Chapter 2</i>	<i>Deep Convolution Network</i>	12
2	24-07-2022	Computer vision (CV) and applications, Disadvantage of applying DNN in CV (use case in lab work), convolutions and filters with examples, feature maps, pooling (max and average), and strides	4
		<u>Lab Work 2:</u> <ul style="list-style-type: none"> <li>MNIST using DNN</li> <li>Convolution and Pooling step-by-step in python</li> <li>MNIST using CNN</li> </ul>	
		<u>Assignment 2:</u> <ul style="list-style-type: none"> <li>Cifar10 and Cifar100 using CNN</li> </ul>	
3	31-07-2022	Tensorflow – Image Generator, Augmentation, Regularization	4
		<u>Lab Work 3:</u> <ul style="list-style-type: none"> <li>Building CNN to classify Indian Classical Dance</li> <li>Visualizing effect of CNN Layers</li> </ul>	
		<u>Assignment 3:</u> <ul style="list-style-type: none"> <li>Building CNN to classify different breed of snakes and visualizing the effect of CNN layers for each breed</li> </ul>	
4	07-08-2022	Case Study: Speech Recognition using CNN, basics of audio speech recognition, spectral bandwidth, short term Fourier transform, and MFCC spectral	4
		<u>Lab Work 4:</u> <ul style="list-style-type: none"> <li>Building a CNN model to identify emotions from an audio speech</li> </ul>	
		<u>Assignment 4:</u> <ul style="list-style-type: none"> <li>To design and build a CNN model to identify dysarthria disease</li> </ul>	

	<i>Chapter 3</i>	<i>Deep Sequence Modelling</i>	16
5	14-08-2022*	<p>Applications and relationships, Neurons with recurrence, RNN and intuition, backpropagation through time, gradient issues, tokenization, pad sequences and embeddings</p> <p><u>Lab Work 5:</u></p> <ul style="list-style-type: none"> <li>To build a sarcasm NLP classifier using Embeddings</li> </ul> <p><u>Assignment 5:</u></p> <ul style="list-style-type: none"> <li>To build an NLP model to combat fake news/contents menace using Embeddings</li> </ul>	4
6	21-08-2022	<p>RNN for time series, LSTM, and bidirectional LSTM</p> <p><u>Lab Work 6:</u></p> <ul style="list-style-type: none"> <li>To build LSTM model for grocery sales forecasting</li> </ul> <p><u>Assignment 6:</u></p> <ul style="list-style-type: none"> <li>Build a LSTM model with and without return sequences using any TS data</li> <li>Write a report on Convolution with LSTM with its architecture</li> </ul>	4
7	28-08-2022	<p>Case Study 1: Image captioning, tokenizer and feature using sequences and Xception network, and model architecture for image captioning</p> <p><u>Lab Work 7:</u></p> <ul style="list-style-type: none"> <li>To build image captioner using CNN-DNN-RNN in Flickr 8k dataset</li> </ul> <p><u>Assignment 7:</u></p> <ul style="list-style-type: none"> <li>In group of 5 build an image captioner using COCO dataset</li> <li>Write a report on recent developments in COCO dataset</li> </ul>	4
8	04-09-2022	<p>Case Study 2: Netflix Movie Tag Generation, vectorization, LSTM with NLP, and return sequences</p> <p><u>Lab Work 8:</u></p> <ul style="list-style-type: none"> <li>To generate Netflix movie tags using Embeddings and LSTM</li> </ul> <p><u>Assignment 8:</u></p> <ul style="list-style-type: none"> <li>In group of 3, build a system to predict book genre using LSTM in NoSQL</li> <li>Design a model prototype for text generation with examples.</li> <li>Write a report on BERT and Transformers (individual assignment)</li> </ul>	4
	<i>Chapter 4</i>	<i>Transfer Learning and Object Detection</i>	12
9	11-09-2022	<p>About transfer learning, weights sharing, VGG16, Xception, InceptionV3</p> <p>Discussion on project</p> <p><u>Lab Work 9.1:</u></p> <ul style="list-style-type: none"> <li>VGG16, Xception, InceptionV3 to classify cats and dogs in tensorflow</li> </ul> <p><u>Assignment 9.1:</u></p> <ul style="list-style-type: none"> <li>Draw VGG16, Xception and InceptionV3 network</li> </ul>	4

10	18-09-2022	ResNet 50, 101, 152 and DenseNet 121, 161, and U-NET Discussion on project	4
		<u>Lab Work 9.2:</u> <ul style="list-style-type: none"> <li>ResNet 50, 101, 152 and DenseNet 121, 161 to classify cats and dogs in fastai</li> </ul>	
		<u>Assignment 9.2:</u> <ul style="list-style-type: none"> <li>Draw ResNet 50, 101, 152 and DenseNet 121, 161</li> <li>Design U-NET for car and truck classification</li> </ul>	
11	25-09-2022*	Case Study: Object Detection, R-CNN,	4
		<u>Lab Work 10:</u> <ul style="list-style-type: none"> <li>To implement R-CNN in Tensorflow Hub</li> </ul>	
		<u>Assignment 10:</u> <ul style="list-style-type: none"> <li>Write a report on recent developments in object detection including YOLO.</li> <li>In group of 3, design an object detection prototype for identifying bike helmet</li> </ul>	
	<i>Chapter 5</i>	<i>Deep Generative Modelling</i>	8
12	02-10-2022	About generative modelling, and anomaly detection using auto encoder	4
		<u>Assignment (Uncredited):</u> <ul style="list-style-type: none"> <li>Implement auto encoder to convert high resolution image to low resolution</li> <li>Variational Auto Encoder</li> </ul>	
13	09-10-2022	GANs, generator and discriminator implementation	4
		Miscellaneous	8
14	16-10-2022	Project Presentation	4
15	23-10-2022	Deploying DL Models and MLOps Discussion on Recent Developments in DL – GPT 3 and DALL E	4

\* ICA Test – 20 marks each

Dates are tentative | Assignments: 30 marks

#### Text Books:

- Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing, 2018.
- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

#### Reference Books:

- Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006.
- Duda, Richard, Peter Hart, and David Stork, Pattern Classification, 2nd edition, Wiley-Interscience, 2000.
- Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
- Reza Zadeh, Bharath Ramsundar, TensorFlow for Deep Learning, 1st edition, O'Reilly Media Inc, 2018.
- Zaccone, Giancarlo, Deep Learning with TensorFlow, 2nd edition, Packt Publishing, 2018.