GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Integrated MSc, 9th Semester
Branch: Computer Science
Subject Name: Deep Learning
Subject Code: 1390304

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA (M)	PA (I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Content:

Sr. No.	Content	Teaching Hours	Module Weightage (%)
1	**Fundamentals of Machine Learning** Four branches of machine learning, Evaluating machine-learning models, Data preprocessing, feature engineering, and feature learning, Overfitting and under fitting, The universal workflow of machine learning.	5	15
2	**Artificial Neural Networks and Deep Neural Networks** A first look at a neural network, Data representations for neural networks, the gears of neural networks: tensor operations, the engine of neural networks: gradient-based optimization, Anatomy of a neural network, Introduction to Keras, setting up a deep-learning workstation, classifying movie reviews: a binary classification example, classifying newswires: a multiclass classification example, Predicting house prices: a regression example.	8	20
3	**Deep Learning for Computer Vision** Introduction to convenets, The convolution operation, The max-pooling operation, Training a convnet from scratch on a small dataset, The relevance of deep learning for small-data problems, Downloading the data, Building your network, Data preprocessing, Using data augmentation, Using a pretrained convnet, Feature extraction, Fine-tuning, Visualizing what convnets learn, Visualizing intermediate activations, Visualizing convnet filters, Visualizing heatmaps of class activation	9	20
4	**Deep Learning for Text and Sequences** Working with text data, One-hot encoding of words and characters, Using word embeddings, Putting it all together: from raw text to word embeddings, Understanding recurrent neural networks, A recurrent layer in Keras, Understanding the LSTM and GRU layers, A concrete LSTM example in Keras, Advanced use of recurrent neural networks, A temperature-forecasting problem, Preparing the data, A common-sense, non-machine-learning	9	20

	baseline, A basic machine-learning approach, A first recurrent baseline, Using recurrent dropout to fight overfitting, Stacking recurrent layers, Using bidirectional RNNs		
5.	**AUTOENCODERS AND GENERATIVE MODELS :** Autoencoders: Undercomplete autoencoders -- Regularized autoencoders – Stochastic encoders and decoders -- Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks.	5	15
6.	Trending methodological and application areas of Deep Learning.	4	10

Reference Books:

1. Deep Learning with Python by Francois Chollet. Manning Publications Co., Latest Edition.
2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron An MIT Press book.
3. Neural Networks and Deep Learning by Michael Nielsen http://neuralnetworksanddeeplearning.com
4. Pattern Classification by Richard O. Duda, Peter E. Hart, David G. Stork John Wiley & Sons Inc
5. Deep Learning with Keras, by Antonio Gulli, Sujit Pal, Packt Publishing, 2017.

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the deep neural networks methodologies.	UN
02	Apply the deep learning methods with parameter tuning on computer vision applications.	AP
03	Apply the deep learning methods with parameter tuning on text and sequences data.	AP
04	Analyze different deep learning methods in varying conditions of the applications.	AN
05	Evaluate the performance of different deep learning methods.	EV

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

Required Software: Python Programming Language and IDE

1. Style transfer for images using neural style transfer to apply the style of one image to another.
2. Building multi-layer neural networks with PyTorch to perform classification on a human

resources dataset.

3. Using convolutional neural networks to perform image classification on a dataset of faces. It describes preprocessing the image data, defining the CNN model, and training and evaluating the model.
4. Design & implement a simple deep learning network for classification of images use MNIST dataset.
5. Implement any one of the algorithms VGG to classify objects in objects
6. Design a deep learning network for fine tuning of convolution networks use MNIST dataset.
7. Implement RNN for handwriting digit recognition
8. Implement Bidirectional LSTM for sentiment analysis.
9. Implement Region Based CNN for object detection.
10. Implement Bidirectional RNNs for music generation and voice generation.