SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Master of Technology

Year: M. Tech. I (Semester – II)

Subject Name: Deep Learning **Subject Code:** MTCO23202
Type of course: Professional Core Course
Prerequisite (if any): Basics of Python programming

List of Courses where this course will be prerequisite: --

Rationale: Deep Learning is the fastest-growing area in computer science. This course focuses on giving a detailed insight on various Deep learning paradigms and models that will enable students to create effective solutions that recognize complex patterns in images, text, sounds, and other data to produce accurate insights and predictions.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Artificial Neural Network : Single and Multilayer Perceptrons, Feedforward Neural Networks (FNN), Activation Functions (Step, Sigmoid, Tanh, ReLu and its variants. Softmax), loss functions (binary cross-entropy, categorical cross-entropy, mean squared error, mean absolute error, maximum likelihood estimation).	6
2	Training Deep Neural Network : Introduction to Deep Learning and its architecture, Gradient Descent (Batch Gradient descent, Stochastic Gradient descent, Mini Batch Gradient descent), Backpropagation, Hyper parameter tuning: bias vs. variance tradeoff, batch normalization, early stopping,	8

	optimizers (Adam, AdaGrad, RMSProp), learning rate, dropout, pruning (L1 and L2 Regularization).	
3	Convolutional Neural Networks (CNN) : Architecture of convolutional network: convolution layer and convolution operation, filters and feature map, pooling layer, padding, striding; Parameter computation (weights and bias); Vanishing Gradient and exploid problem;	10
4	Pre-trained Models and Transfer Learning : AlexNet, VGG, GoogLeNet, ResNet, MobileNet; Transfer Learning and data augmentation, Case study: image classification using CNN.	6
5	Sequence Models : Recurrent Neural Network (RNN), LSTM, GRU, Transformer, Applications of Sequence Models: Word Embeddings - Word2Vec, GloVe, BERT. Encoder Decoder Models, Attention Mechanism.	8
6	Generative Adversarial Networks (GAN) : Auto encoder and its types, Introduction to GAN, Training GAN - various types of Generator networks and Discriminator networks, 1-dimentional GANs, 2-dimensional GANs, Measures of Quality for GANs, Applications of GAN.	7

Reference Books:

Sr No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Fundamentals of Deep Learning	Nikhil Buduma	O-Reilly	2019	3rd Edition
2	Deep Learning Using Python	S Lovelyn Rose, L Ashok Kumar, D Karthika Renuka	Wiley	2020	1st edition
3	Deep Learning	Goodfellow, I.,Bengio,Y., Courville, A.,	MIT Press,	2016	

4	Deep Learning with Python	Francois Chollet	Manning	2017	
5	Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play	David Foster	O'Reilly Media, Inc.	2019	1st Ed.
6	GANs in Action: Deep learning with Generative Adversarial Networks	Jakub Langr, Vladimir Bok	Manning	2019	1st Ed.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Use neural network models for various applications with fine-tuning to continuously improve the models.	30
CO-2	Solve object classification problems using CNNs.	20
CO-3	Utilize the knowledge of pre-trained models to solve the relevant problems.	15
CO-4	Implement sequence models for text analysis.	18
CO-5	Apply the basic principles to derive the various Generator and Discriminator Networks	17

List of Open learning website:

- Deep Learning Part 1 (IITM), By Prof. Sudarshan Iyengar & Prof.Mitesh M. Khapra https://onlinecourses.nptel.ac.in/noc19_cs85/preview
- Deep Learning, By Prof. Prabir Kumar Biswas, IIT Kharagpur, https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs54/

List of Open Source Software:

- Python
- Tensorflow
- Keras
- OpenCV
- Pytorch
- NLTK

FOR LAB SESSIONS:

List of Experiments:

Sr. No.	Practical
1.	Implement ANN for XOR logical gate. (2 hrs)
2.	Design and implement multilayer perceptron for classification of MNIST digits with various activation functions, loss functions. optimization algorithms, and hyper-parameter tuning. (4 hrs)
3.	Create your own CNN architecture and perform 4-class classification from CIFAR-10 dataset. (6 hrs)
4.	Implement image classification on the dataset of your choice using pre-trained CNN and understand how to set train/validation/test sets and analyze bias/variance. (6 hrs)
5.	Design and train a simple GAN: Experiment with various Generator and Discriminator paradigms, and loss functions. (6 hrs)
6.	Mini Project: Design a text processing model to solve one of the following problems. (6 hrs) 1. Sentiment analysis 2. Fake news detection