COURSE CONTEXT

SCHOOL	**SCSET**	**VERSION NO. OF CURRICULUM/SYLLABUS THAT THIS COURSE IS A PART OF**	**VI**
DEPARTMENT	**NA**	**DATE THIS COURSE WILL BE EFFECTIVE FROM**	**Jan-June, 2024**
DEGREE	**B.Tech**	**VERSION NUMBER OF THIS COURSE**	**1**

COURSE BRIEF

COURSE TITLE	**Deep Learning**	**PRE-REQUISITES**	**NA**
COURSE CODE	**CSET-335**	**TOTAL CREDITS**	**3**
COURSE TYPE	**General Elective**	**L-T-P FORMAT**	**2-0-2**

COURSE SUMMARY

This course aims at teaching supervised, unsupervised and reinforcement deep learning methods which helps to develop state-of-the-art artificial intelligence applications.

COURSE-SPECIFIC LEARNING OUTCOMES (CO)

CO1: To explain the fundamentals of deep learning, Convolution neural network.
CO2: To articulate different problem of classification, detection, segmentation, generation and understand existing solutions/ deep learning architectures.
CO3: To implement a solution for the given problem and improve it using various methods transfer learning, hyperparameter optimization.

Detailed Syllabus

Module 1 (Contact hours: 7)
Why Deep Learning?, Machine Learning: features, weights, Artificial Neural Network, loss function, cost function, ANN: forward propagation; Backpropagation, Stochastic Gradient Descent, Batch gradient descent, mini batch gradient descent, Optimizers: Momentum, RMSProp, Adam, Deep Learning Experiments: Datasets, training-validation testing set, evaluation measures: accuracy, precision, recall, f-measure, Model Improvement: Overfitting vs underfitting, Bia Variance, Regularization: L1, L2 regularization, Dropout, Early stopping, Data normalization, Batch normalization, Hyper parameter Tuning: random, coarse to fine, Network architecture search.

Module 2 (Contact hours: 11)
Imbalance data problem (25)

Data Augmentation in image: Cropping, Flipping, Rotation, Brightness, Contrast, Color Augmentation, Saturation, Convolutional Neural Networks: convolution, striding, padding, pooling, Alexnet Architecture, Image classification (ImageNet Challenge), Well known CNN architectures VGG16&19, Residual Block, Resnet50, 1x1 convolution, XceptionNet, EfficientNet, Transfer learning, Object Detection: setup problem and cost function, well known datasets, Evaluation measure: Average precision, Mean average precession, Two stage detector, single stage detector, RCNN, Fast RCNN, Faster RCNN, SSD, YOLO1-4, RetinaNet, EfficientDet, Image Segmentation: setup problem and cost function, various dataset, Semantic segmentation, Instance segmentation, Evaluation measure: IoU/Jacard Index, Dice score, Mean pixel accuracy, Segnet, Unet, Mask R-CNN.

Module 3 (Contact hours: 10)

Generative Learning, Variational Auto-encoders, Generative Adversarial Neural Networks, GL Applications: Image generation, font generation, video generation, anime face/celebrity face generation, Deep Reinforcement Learning, Markov decision Processing, Deep Q Learning, Exploration vs Exploitation, Value Iteration vs Policy Iteration, RL Applications: Robotics, gaming, Ad Targeting, recommendation system, decision making, Model optimization for Deployment, Pruning, Quantization and binarization, Transferred or Compact Convolutional Filters, Knowledge distillation.

STUDIO WORK / LABORATORY EXPERIMENTS:

Aim of this lab is to focus on gathering, pre-processing tabular, visual, textual and audio data for building deep learning models using standard Python libraries. To train, improve, and deploy deep learning models in different devices. To analyse performance of different deep learning models using speed, accuracy, size trade-offs.

TEXTBOOKS/LEARNING RESOURCES:

a) Ian Goodfellow, Yoshua Bengio, Aaron Courville, and Yoshua Bengio. Deep learning. Vol. 1. Cambridge: MIT press, 2016.

REFERENCE BOOKS/LEARNING RESOURCES:

a) Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, Dive into Deep Learning, 2018.