PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY,
SOLAPUR Final Year B.Tech. (COMPUTER SCIENCE & ENGINEERING)

Honors Degree: AI & ML
SEMESTER – II

HN: Deep Learning

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours /Week, 3 credits	ESE - 70 Marks
Practical: 2 Hour/Week, 1 credit	ISE – 30 Marks
	ICA- 25 Marks

COURSE OUTCOMES:

At the end of this course, students will be able to

1. Thoroughly understand the fundamentals of Deep Learning.
2. Get familiar with the various Deep Learning techniques currently being used.
3. Design a deep neural network for a given task.
4. Configure deep learning algorithms and learn how to train deep networks.
5. Use various frameworks required for creating neural networks along with their functionalities

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SECTION – I

Unit 1: Neural Network and Deep Learning (7)

Introduction to AI, ML and Deep Learning, Machine Learning basics, Learning algorithms – Supervised and Unsupervised Training, A brief history, Need of Deep Learning, Basics of neural network, Biological Neuron vs. Artificial Neuron, Linear Neurons and their Limitations, Perceptron, Multilayer perceptron, The first example of network with Keras code, Back propagation.

Unit 2: Deep Neural Network Design and Training (7)

Introduction to Simple DNN, Deep Feed Forward Networks , Learning XOR problem, Gradient-Based Learning, Various Activation Functions, Tanh, ReLU, Sigmoid – Loss Functions, Regularization methods for Deep Learning, Early Stopping, Drop Out, Difficulty of training deep neural networks

Unit 3: Tools and Techniques for DNN (8)

What Is Tensor Flow? Introduction, Downloading and installation of Tensor flow, the tensor flow computation graph, Benefits of tensor flow, Keras: introduction, use of keras, installation of keras, creating a Keras Model, PyTorch, Batch normalization, Vanishing Gradient, Exploding Gradient, Hyperparameters tuning for DNN, Deep Learning application with Keras: Diabetes patient classification.

SECTION – II

Unit 4: Convolution Neural Networks (CNN) (6)

Introduction, Convolution Operation, Motivation, Pooling, Normalization, Applications in Computer Vision – ImageNet, Sequence Modeling –VGGNet, Darknet.

Unit 5: Recurrent Neural Networks (RNN) (6)

Sequential data and problems, RNN topologies- Difficulty in Training RNN, Long Short Term Memory, Bidirectional LSTMs, Bidirectional RNNs, Application case study -Handwritten digits recognition using deep learning.

Unit 7: Basics of Auto encoders and Transfer learning (6)

Auto encoders, Components, Uses of Auto encoders, formulations of auto encoders, training auto encoders, types of auto encoders, transfer learning.

Internal Continuous Assessment (ICA):
Minimum 8 to 10 assignments based on following list requiring students to design, implement and validate deep learning based machine Learning models using openly available deep learning libraries or any other machine learning toolkits. The assignment's objective should align with course's outcomes and focus on higher order bloom's cognitive levels.

1. Create a deep learning model with MNIST dataset to predict the handwritten digits.
2. Build a CNN classification model for Flower classification using Tensorflow Keras.
3. Build a CNN classification for multi-class classification using CIFAR100 dataset. Dataset is inbuilt in TensorFlow Keras: tf.keras.datasets.cifar100.load_data().
4. Build a deep learning model for multi-class classification using Fashion-MNIST, dataset of fashion articles with 10 classes and each image is 28*28 pixel.
5. You are given a news aggregator dataset which contains news headlines, URLs, and categories for 422.937 news stories collected by a web aggregator. These news articles must be categorized into business, science and technology, entertainment, and health.

   Objective: Perform multiclass classification using LSTM.

   Note: Use uci-news-aggregator.csv for the above task.
6. Use of LSTM for sentimental analysis in keras: The motive of your company behind building a sentiment analyzer is to determine employee concerns and to develop programs to help improve the likelihood of employees remaining in their jobs.

   Objective: Use LSTM to perform sentiment analysis in Keras.

   Note: Use the inbuilt dataset imdb from sklearn. datasets for this task.
7. Build an autoencoder model to regenerate the objects of the given MNIST dataset.

   Objective: Regenerate the objects of MNIST dataset using autoencoder model.
8. Implementation of transfer learning
9. Build the deep learning model for diabetes disease prediction Use the dataset from: https://www.kaggle.com/uciml/pima-indians-diabetes-database
10. Hyperparameter tunning using grid search technique for improving performance of deep learning model.

Textbooks:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. Machine Learning A Probabilistic Perspective by Kevin P. Murphy, MIT Press.
3. Deep Learning Methods and Applications by Li Deng and Dong Yu, NOW Publishers.
4. Keras: The Python deep learning API https://keras.io/ (eResource)

Reference Books:
1. Deep Learning by Rajiv Chopra, 2nd edition, Khanna Publishing.