COURSE CONTENT

DEEP LEARNING								
I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2215814	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: A course on "Data structures and algorithms, Artificial Intelligence"								

Course Overview:

Deep Learning is an advanced area of artificial intelligence that focuses on training neural networks to learn complex patterns from large datasets. The course covers artificial neural networks, backpropagation, optimization techniques, and deep architectures such as CNNs, RNNs, and Transformers. It emphasizes practical implementation using Python and popular frameworks like TensorFlow and PyTorch.

Course Objectives:

1. To understand the fundamental concepts, architectures, and challenges of deep learning algorithms and neural networks.
2. To study training techniques, optimization methods, regularization, and performance improvement strategies for deep neural networks.
3. To learn advanced deep learning models such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), LSTMs, and Autoencoders.
4. To explore the applications of deep learning in computer vision, image processing, and generative models.
5. To apply deep learning techniques in Natural Language Processing (NLP), sentiment analysis, and sequence modeling tasks.

Course Outcomes: After Completion of the Course, Students should be able to

1. Implement gradient descent and backpropagation for training neural networks.
2. Evaluate the performance of autoencoders, GANs, and memory models for unsupervised learning tasks.
3. Implement deep learning architectures like CNNs and GANs for tasks like image generation and object detection.
4. Analyze word similarity tasks and evaluate the quality of word representations in various NLP applications.
5. Implement LSTM and RNN models for various NLP tasks, including dialogue generation and sentiment analysis.

UNIT - I:

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II:

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT - III:

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT - IV:

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

UNIT - V:

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press

REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004

ELECTRONIC RESOURCES:

1. https://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. https://neuralnetworksanddeeplearning.com/

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topic
4. Open-ended experiment
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – I
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)