COURSE CONTENT

DEEP LEARNING								
II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSE16	**Elective**	3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Artificial Neural Networks								

I. COURSE OVERVIEW:

This course is designed to introduce students to the theoretical foundations, algorithms, and practical applications of deep learning techniques. Students will explore various neural network architectures, learn to build, and train models using popular frameworks, and apply these techniques to solve real-world problems in diverse domains.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The principles of artificial neural networks and deep learning.
II. The deep learning techniques to tasks including computer vision, natural language processing

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	Summarize the basic principles of feedforward, recurrent, and convolutional neural network architectures
CO2	Comprehend the principles of Learning, training, testing, and validation of Deep Learning models
CO3	Apply deep learning techniques in domains such as computer vision, natural language processing
CO4	Outline domain-specific challenges and how deep learning can be adapted to solve them
CO5	Analyze the data using multilayer perceptron and backpropagation algorithms
CO6	Develop a model for domain-specific applications by applying various network models in deep learning.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Introduction: Historical Trends in Deep Learning - Learning algorithms: Supervised and Unsupervised Training - Linear Algebra for Machine Learning - Testing - Cross Validation - Dimensionality Reduction - Overfitting/Under Fitting - Hyperparameters and validation sets - Estimators – Bias – Variance - Loss Function- Regularization

MODULE-II: ARCHITECTURE (10)

Architecture: Biological Neuron – Idea of Computational units - Linear Perceptron - Perceptron Learning Algorithm - Convergence theorem for Perceptron Learning Algorithm - Linear Separability - Multilayer perceptron – Backpropagation.

MODULE-III: MODERN PRACTICES IN DEEP NETWORKS (09)

MODERN PRACTICES IN DEEP NETWORKS: Simple DNN - Platform for Deep Learning - Deep Learning Software Libraries - Deep Feedforward networks – Gradient-Based Learning - Architecture Design,

Various Activation Functions, ReLU, Sigmoid – Error Functions - Regularization methods. for Deep Learning - Early Stopping - Drop Out - Optimization methods for Neural Networks-Adagrad, Adam.

MODULE-IV: CONVOLUTIONAL NEURAL NETWORKS (CNNS) (09)

Convolutional Neural Networks (CNNs): CNN Fundamentals – Architectures – Pooling – Visualization – Sequence Modeling: Recurrent Neural Networks (RNN) - Long-Short Term Memory (LSTM) – Bidirectional LSTMs-Bidirectional RNNs -Deep Unsupervised Learning: Autoencoders – Auto Encoder Applications -Deep Boltzmann Machine (DBM).

MODULE-V: APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION (09)

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.
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,

V. TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 4th edition, MIT Press,2016.

VI. REFERENCE BOOKS:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Michael A. Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013 Satish Kumar,

VII. WEB REFERENCES:

1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft_computing.html

VIII E-Text Books:

1. https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/DeepLearning-NowPublishing-Vol7-SIG-039.pdf

2. https://cours.etsmtl.ca/sys843/REFS/Books/ebook_Haykin09.pdf
3. https://www.programmer-books.com/applied-deep-learning/

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open,Ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper, I
8. Model question paper, II
9. Lecture notes
10. Power Point presentation
11. E-Learning Readiness Videos (ELRV)