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| **Course Code** | **Course Title** | | | | **Category** |
| **18BTIS701** | **Deep Learning** | | | | **Core** |
| **Contact Hours per Week** | | | **CA** | **FE** | **Credits** |
| **L** | **T** | **D/P** |
| 3 | 0 | 0 | **40** | **60** | **3** |
| **Prerequisite:** Machine Learning | | | | | |
| **Course Objectives: ( 3 to 5 ):**  1. To introduce students to the basic concepts and techniques of deep Learning.  2. To become familiar with CNN and sequential modeling.  3. To learn and understand advanced deep architectures. | | | | | |

**COURSE CONTENT**

**Unit I Revisiting Machine Learning Fundamentals**

The Neural Network, The Neuron, Expressing Linear Perceptron as Neurons, Feed-forward Neural Networks, Linear Neurons and their Limitations, Sigmoid Tanh and ReLU Networks, Softmax Output Layers. Training Feed-Forward Neural Network, Gradient Descent, The Back propagation Algorithm, Test Sets, Validation Sets, and Over fitting, Preventing Over fitting in Deep Neural Networks.

**Unit II Deep Networks**

Deep feed forward networks, Gradient-Based Learning, Hidden Units, Architecture Design, The Challenges with Gradient Descent, Learning Rate Adaptation, AdaGrad—Accumulating Historical Gradients, RMSProp—Exponentially Weighted Moving Average of Gradients, Adam—Combining Momentum and RMSProp, Regularization for deep learning.

**Unit III Convolutional Networks**

The Convolution Operation, Pooling, Variants of the Basic Convolution Function, Case study Building a Convolutional Network for CIFAR-10, Visualizing Learning in Convolutional Networks, Introduction to pre-trained CNN- VGG 16, Inception, ResNet, Case study.

**Unit IV Sequence Modelling**

Recurrent Neural Networks , Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs, Case study Sentiment Analysis Model.

**Unit V Advances in Deep Learning and Applications**

Autoencoders, Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Deep Generative Models, Applications of Deep Learning

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**Course Outcomes**

1. To identify and apply deep learning techniques to solve real world problems

2. To solve complex problem using deep neural networks

3. To apply and implement CNN and RNN for suitable applications

4. To apply and use advanced deep architectures

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**Text Books**

* Ian Goodfellow and Yoshua Bengio, Deep Learning (Adaptive Computation and machine Learning Series), Massachusetts London, England, ISBN No. 9780262035613.
* Nikhil Buduma, Fundamentals of Deep Learning, O’Reilly, First Edition, ISBN No. 978-14-919- 2561-4.

**Reference Books**

* Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw-Hill, ISBN No. 0- 07-115467-1.
* Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07-115467-1
* Shai shalev-Shwartz and Shai Ben-David, Understanding Machine Learning(From Theory to Algorithms), Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.
* Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127