**Module 1**

Fundamentals of Neural Network:

Biological neuron,

Mc-Culloch Pitts Neuron,

Perceptron,

Perceptron Learning,

Delta learning, Multilayer Perceptron:

Linearly separable, linearly non-separable classes.

Deep Networks: Fundamentals,

Brief History, Three Classes of Deep Learning

Basic Terminologies of Deep Learning

**Module 2**

Multi Layered Feed Forward Neural Network,

Training Feedforward DNN

Activation functions:

Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU,

Training, Optimization and Regularization of Deep Neural Network:

Learning Factors,

Loss functions: Squared Error loss, Cross Entropy,

Choosing output function and loss function

Optimization

Learning with backpropagation,

Learning Parameters:

Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD,Nesterov GD,

AdaGrad, Adam, RMSProp

Regularization

Overview of Overfitting, Types of biases, Bias Variance Trade-off,

Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight

Decay, Batch normalization, Early stopping, Data

Augmentation, Adding noise to input and output

**Module 3**

Auto encoders: Unsupervised Learning:

Introduction, Linear Auto encoder, Under

complete Auto encoder, Over complete Auto

encoders, Regularization in Auto encoders

Denoising Auto encoders, Sparse Auto

encoders, Contractive Auto encoders Application

of Auto encoders: Image Compression

**Convolutional Neural Networks (CNN):**

**Supervised Learning :**Convolution operation,

Padding, Stride, Relation between input, output

and filter size, CNN architecture: Convolution

layer, Pooling Layer, Weight Sharing in CNN,

Fully Connected NN vs CNN, Variants of basic

Convolution function Modern Deep Learning

Architectures: LeNET: Architecture, AlexNET:

Architecture

**Recurrent Neural Networks (RNN) :** Sequence

Learning Problem, Unfolding Computational

graphs, Recurrent Neural Network, Bidirectional

RNN, Backpropagation Through Time (BTT),

Vanishing and Exploding Gradients, Truncated

BTT Long Short Term Memory: Selective Read,

Selective write, Selective Forget, Gated Recurrent

Unit

**Recent Trends and Applications**: Generative

Adversarial Network (GAN): Architecture

Applications: Image Generation, Deep Fake