CENTRAL UNIVERSITY OF KERALA
DEPARTMENT OF COMPUTER SCIENCE
M.Sc. COMPUTER SCIENCE – PROGRAMME STRUCTURE

ELECTIVES				
COURSE CODE	COURSE TITLE	CONTACT HRS/WEEK		CREDITS
		LEC	LAB	TUT	
CSC5015	Deep Learning	2	2	1	4

Lec = Lecture, Tut = Tutorial, Lab = Practical

This is an experimental, problem solving and **employability based skill development course**.

Course Objective:
   The objective of the course is to provide theoretical and practical aspects of deep learning.

By completing this course, students will obtain the following course/learning outcomes:
1. Knowledge gained:
   (i)   Fundamental concepts of deep learning.
2. Skill gained:
   (ii) Development of algorithms for deep learning applications.
3. Competency gained:
   (iii) Computational modelling of various real world problems using deep learning techniques.

Prerequisites: Basic knowledge of algorithms.

Grading:
Lab implementation	– 15%
Participatory based group Project	– 10%
Assignment/Quiz/presentation	– 5%
Class Test	– 10%
Final Exam	– 60%

CSC5015 – Deep Learning

Module 1
History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, FeedForward Neural Networks, Backpropagation

Module 2
Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Principal Component Analysis and its interpretations, Singular Value Decomposition, Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders

Module 3
Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization, Learning Vectorial Representations of Words

Module 4
Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks, Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

References:
1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, An MIT Press book, 2016
2. http://www.deeplearningbook.org