SEMESTER S7

DEEP LEARNING

Course Code	**PEEET753**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Basic understanding of probability theory, linear algebra and machine learning	**Course Type**	Theory

Course Objectives:

1. To introduce the building blocks used in deep learning like neural networks, deep neural networks, convolutional neural networks and recurrent neural networks
2. To learn and understand various learning and optimization techniques such as Gradient Descent, Adam
3. To solve a wide range of problems in Computer Vision and Natural Language Processing

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Neural Network:** Introduction to neural networks -Single layer perceptrons, Multi Layer Perceptrons (MLPs), Activation functions - Sigmoid, Tanh, ReLU, Softmax, Risk minimization, Loss function, Training MLPs with Backpropagation, Practical issues in neural network training - The problem of Overfitting, Vanishing and Exploding gradient problems, Difficulties in convergence, Local and spurious Optima, Computational challenges. Applications of neural networks	9
2	**Deep Learning:** Introduction to Deep Learning, Deep Feed Forward network, Training deep learning models, Optimization techniques - Gradient Descent (GD), GD with momentum, Nesterov accelerated GD, Batch, Mini-batch and Stochastic GD, AdaGrad, RMSProp, Adam	9
3	**Convolutional Neural Network (CNN):** Introduction to CNN - Convolution and Pooling, Convolution and Pooling as	9

	an infinitely strong prior, variants of convolution functions, Efficient convolution algorithms, Applications - Computer Vision	
4	**Recurrent Neural Network (RNN):** Introduction to RNN - Computational graphs, RNN design, Encoder-decoder sequence to sequence architectures, Deep RNNs, Modern RNN - LSTM and GRU, Applications - Natural Language Processing (NLP),	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Illustrate the basic concepts of neural networks and its practical issues	**K2**
CO2	Outline the standard regularization and optimization techniques for deep neural network	**K2**
CO3	Implement the foundation layers of convolutional neural networks, pooling and convolution	**K2**
CO4	Implement sequence model using recurrent neural networks	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3				2						3
CO2	3	3				2						3
CO3	3	3				2						3
CO4	3	3	3	2	3	3					2	2

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Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Neural Networks and Deep Learning	Charu C. Aggarwal	Springer	2018
2	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms	Nikhil Buduma and Nicholas Locascio	O'Reilly Media	2017
3	Deep Learning	Ian Goodfellow, Yoshua Bengio,Aaron Courville	MIT Press	2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Neural Networks and Deep Learning	Michael Nielsen	http://neuralnetworksanddeeplearning.com/	2018
2	Neural Networks: A Classroom Approach	Satish Kumar	Tata McGraw-Hill Education	2014
3	Artificial Neural Networks	Yegnanarayana, B	PHI Learning Pvt. Ltd	2009

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/106/105/106105215/
2	https://archive.nptel.ac.in/courses/106/106/106106184/
3	https://archive.nptel.ac.in/courses/106106201/
4	https://archive.nptel.ac.in/courses/106106224/

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