SEMESTER S6

DEEP LEARNING

Course Code	PECST632	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)	None	Course Type	Theory

Course Objectives:

1. To give the learner an understanding about the foundations of Deep Learning architecture and applications
2. To equip the learner with the necessary skills to set-up neural network architecture and use it for real time problem solution.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient descent, Curse of Dimensionality, Deep feedforward networks.	8
2	Machine Learning and Deep learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.	9
3	CNN-Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, Alexnet – Applications. Recurrent Neural Networks, Bidirectional RNNs, Encoder – decoder sequence to sequence architectures – BPTT for training RNN, Long Short Term Memory Networks.	10
4	Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks. Regularized Autoencoder, stochastic Encoders and Decoders, Contractive Encoders. GAN and its variants	9

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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

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**

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Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Construct fundamental neural network architectures and algorithms, including Multilayer Perceptron and Back-propagation	**K3**
CO2	Apply advanced techniques such as Stochastic Gradient Descent and address the Curse of Dimensionality in the context of deep learning models.	**K3**
CO3	Build various deep learning architectures, including feed-forward networks, Convolutional Neural Networks (CNNs), and their applications in real-world problems.	**K3**
CO4	Develop and utilize Recurrent Neural Networks (RNNs) and Long Short-Term Memory Networks (LSTMs) for sequence modeling and natural language processing tasks.	**K3**
CO5	Apply unsupervised learning techniques such as Autoencoders and Generative Adversarial Networks (GANs) to solve complex problems in computer vision and speech recognition.	**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							3
CO2	3	3	2		3							3
CO3	3	3	2		3							3
CO4	3	3	2		3							3
CO5	3	3	2		3							3

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	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	1/e, 2016
2	Neural Networks and Deep Learning	Michael A. Nielsen	Determination Press,	2/e, 2015
3	Learning Deep Architectures for AI	Yoshua Bengio	Now Publishers Inc	1/e, 2009
4	Deep Learning: A Practitioner's Approach	Josh Patterson, Adam Gibson	O'Reilly	1/e, 2017

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks	Umberto Michelucci	Apress	1/e, 2018
2	Deep Learning with Keras	Antonio Gulli, Sujit Pal	Packt	1/e, 2017
3	Deep Learning with Python	Francois Chollet	Manning	1/e. 2017
4	Deep Learning	M Gopal	Pearson	1/e, 2022
5	The Science of Deep Learning	Iddo Drori	Cambridge Univeristy Press	1/e, 2021

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/106105215 (Week 4)
2	https://nptel.ac.in/courses/106105215 (Week 5)
3	https://nptel.ac.in/courses/106105215 (Week 8)
4	https://nptel.ac.in/courses/106105215 (Week 10,11 and 12)

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