Semester: 5th			
Paper code: AIML305	**L**	**T/P**	**Credits**
Subject: Fundamentals of Deep Learning	**4**	**0**	**4**

Marking Scheme:

1. Teachers Continuous Evaluation: As per university examination norms from time to time
2. End Term Theory Examination: As per university examination norms from time to time

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per university norms

1. There should be 9 questions in the end term examination question paper.
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To learn basic computational units inspired from biological systems (brain).
2.	To study various algorithms in deep learning for various domains.
3.	To understand fundamental machine learning concepts w.r.t. neural networks.
4.	To apply deep learning models to solve sequence and vision problems.

Course Outcomes:

CO1	Interpret the basic computational units inspired from biological systems (brain).
CO2	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO3	Define the fundamental machine learning concepts w.r.t. neural networks.
CO4	Apply basic deep learning models to solve sequence-based problems and vision problems.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping

(Scale 1: Low, 2: Medium, 3: High)

CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	1	1	1	2	-	-	-	2	1	2	1
CO2	3	1	1	1	2	1	1	1	2	1	2	2
CO3	3	1	1	1	2	1	1	1	2	1	2	2
CO4	3	1	1	1	2	1	1	1	2	1	2	2

Course Overview:

The main objective of this course is to develop the understanding of key mathematical principles which are used behind the working of neural networks. Convolution Neural Networks and Recurrent Neural Networks have also been covered in this course. This course also provides the details for usage of Deep Learning for Natural Language Processing.

Unit I: **[10]**

Introduction to Deep Learning: Introduction to Deep Learning, Bayesian Learning, Overview of Shallow Machine Learning, Difference between Deep Learning and Shallow Learning, Linear Classifiers ,Loss Function and Optimization Techniques -Gradient Descent and batch optimization.

Unit II: **[10]**

Introduction to Neural Network: Introduction to Neural Network, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation through time. Architectural Design Issues.

Unit III: **[10]**

Training deep neural networks: Difficulty of training deep neural networks, Activation Function, Evaluating, Improving and Tuning the ANN. Hyper parameters Vs Parameters, Greedy layer wise training, Recurrent Neural Networks, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

Unit IV: **[10]**

Convolutional Neural Networks: Convolutional Neural Networks, Building blocks of CNN, Transfer Learning , Pooling Layers , Convolutional Neural Network Architectures.Well known case studies: LeNet, AlexNet, VGG-16, ResNet, Inception Net.Applications in Vision, Speech, and Audio-Video.

Text Books

1. Richard O. Duda," Pattern classification, Wiley, 2022
2. Adam Gibson and Josh Patterson, "Deep Learning: A Practical approach", 2017
3. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

Reference Books

1. Charu C. Aggarwal, "Neural Networks and Deep Learning", 2018
2. Duda, R.O. and Hart, P.E., Pattern classification. John Wiley & Sons, 2006.