Semester	3
Course Title	Deep Learning Fundamentals
Course Code	MMCA311B
Credits	3
Total Hours of Pedagogy	40
L–T–P-S	3-0-0-0
CIE	50
SEE	50
TOTAL	100
Exam Type	Theory
Exam Hours	3 Hrs

Course Learning Objectives:

1. Understand the fundamentals of deep learning
2. Understanding the working of Convolutional Neural Networks and RNN in decision making.
3. Illustrate the strength and weaknesses of many popular deep learning approaches.
4. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

Module I

Introduction: What is a Neural Network? The Human Brain, Models of a Neuron, Neural Networks Viewed as Directed Graphs, Feedback, Network Architectures

Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

Text Book	1
Chapter	1
RBT	L2, L3

Module II

Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The BackPropagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Computer Experiment: Pattern Classification, Back Propagation and Differentiation.

Text Book	1
Chapter	4
RBT	L2, L3

Module III

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problem, Dataset Augmentation, Semi-Supervised Learning.

Optimization for Training Deep Models: How Learning Differs from pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rate.

Text Book	2
Chapter	7
RBT	L2, L3

Module IV

Convolution Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basic for Convolutional Network, Convolutional Networks and the History of Deep Learning.

Text Book	2
Chapter	9
RBT	L2, L3

Module V

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to- Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.	
Text Book	2
Chapter	10
RBT	L3, L4

Course Outcomes (Course Skill Set):
At the end of the course, the student will be able to:

Sl. No.	Course Outcomes	PO	RBT
1	Understanding Deep Learning Fundamentals	PO1, PO2	L2
2	Design and Implementation of Neural Networks	PO1, PO2	L3
3	Optimization and Performance Tuning	PO1, PO2, PO3	L3
4	Application of Advanced Deep Learning Architectures	PO1, PO2, PO3	L4

Suggested Learning Resources:

Text Books:

Sl. No.	Name of the author	Title of the Book	Name of the publisher	Edition and Year
1	Simon Haykin	Neural networks and Learning Machines	Pearson	Third Edition, 2016
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville	Deep Learning	MIT Press	First Edition, 2016

Reference Books:

Sl. No.	Name of the author	Title of the Book	Name of the publisher	Edition and Year
1	Bengio, Yoshua	Learning deep architectures for AI, Foundations and trends in Machine Learning,	IEEE	2009
2	N.D. Lewis	Deep Learning Made Easy with R: A Gentle Introduction for Data Science	AusCov	2016
3	Nikhil Buduma	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms	O'Reilly publications	2013