DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE & Affiliated to Anna University, Chennai)
Accredited with 'A' Grade by NAAC, Accredited by TCS
Accredited by NBA with BME, ECE & EEE
PERAMBALUR - 621 212. Tamil Nadu.
website : www.dsengg.ac.in

COURSE PLAN (2024-2025 **Odd Semester)**

Name of the Faculty				
Designation/Department				
Course Code/Name	**U20IT702/ DEEP LEARNING**			
Year/Section/Department	**IV/IT**			
Credits Details	**L:3**	**T: 0**	**P: 0**	**C:3**
Total Contact Hours Required	**45**			

Syllabus:

UNIT-I INTRODUCTION TO DEEP LEARNING	**9**
Introduction to machine learning - Linear models (SVMs and Perceptron's, logistic regression)- Introduction to Neural Nets: What are a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.	
UNIT-II DEEP NETWORKS	**9**
History of Deep Learning- A Probabilistic Theory of Deep Learning- Back Propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolution Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.	
UNIT-III DIMENTIONALITY REDUCTION	**9**
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convent - Architectures – Alex Net, VGG, Inception, ResNet- Training a Convent: weights initialization, batch normalization, hyper parameter optimization.	
UNITIV OPTIMIZATION AND GENERALIZATION	**9**
Optimization in deep learning– non-convex optimization for deep networks-StochasticOptimizationGeneralizationinneuralnetworks-SpatialTransformerNetworks-Recurrentnetworks,LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning-Computational & Artificial Neuroscience	
UNIT-V CASE STUDY AND APPLICATIONS	**9**
Image Net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	

Objective:

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques.

Text Book:

T1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
T2. Ian Good fellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Book:

R1.Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
R2.Deng& Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
R3.Ian Good fellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.
R4.Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
R5 Yiqiao YIN Statistics Department Columbia University Deep Learning in LATEX February 5, 2018

Website:

W1:Introduction to Deep Learning - GeeksforGeeks
W2: Deep Neural Networks (tutorialspoint.com)
W3:Introduction to Dimensionality Reduction - GeeksforGeeks
W4:Lecture06_OptimizationGeneralization (deeplearning-math.github.io)

Online Mode of Study (if Any):

- Deep Learning - Course (nptel.ac.in)
- Deep learning – IIT Ropar - Course (nptel.ac.in)

Course Plan:

Topic No	Topic Name	Reference Detail	Page No	Teaching Methodology	No of periods required	Cumulative periods
UNITI	**INTRODUCTIONTO DEEP LEARNING**					**(9)**
1.	Introduction to machine learning	T2	29	BB	1	1
2.	Linear models (SVMs)	T2	31	BB	1	2
3.	Perceptron's, logistic regression	T1	198	BB	1	3
4.	Introduction to Neural Nets: What are a shallow network computes	T1	202	BB	1	4
5.	Training a network: loss functions	T1	214	BB	1	5
6.	Back propagation	T2	98	BB	1	6
7.	Stochastic gradient descent	T2	100	BB	1	7
8.	Neural networks	T2	274	BB	1	8
9.	Neural networks as universal function approximates	T2	280	BB	1	9
Outcome of Unit I: **CO1**: Select suitable model parameters for different machine learning techniques. ➢ Understand the basic concepts of machine learning ➢ Understand the phases in back propagation. ➢ Define the Neural networks.						
UNIT-II	**DEEP NETWORKS**					**(9)**
10.	History of Deep Learning.	R5	5	BB	1	10
11.	Probabilistic Theory of Deep Learning.	R5	6	BB	1	11
12.	Back propagation and regularization	R5	9	BB	1	12
13.	Batch normalization	R5	20	BB	1	13
14.	VC Dimension and Neural Nets	R5	34	BB	1	14

15.	Deep Vs Shallow Networks	R5	31	BB	1	15
16.	Convolution Networks	R5	11	BB	1	16
17.	Generative Adversarial Networks (GAN)	R5	21	BB	1	17
18	Semi-supervised Learning.	R5	34	BB	1	18

Outcome of Unit II:

CO 2: Evaluate the performance of existing deep learning models for various applications.

- Understand the fundamental concepts of Deep Networks Convolution Networks.
- Define the process of Generative Adversarial Networks (GAN).
- Gain the knowledge Semi-supervised Learning.

UNIT–III	**DIMENTIONALITY REDUCTION**				**(9)**	
19.	Linear (PCA, LDA) and Manifolds	W1	-	BB	1	19
20.	Metric learning	W1	-	BB	1	20
21.	Auto encoders and dimensionality reduction in networks	R5	31	BB	1	21
22.	Introduction to Conv net	R5	34	BB	1	22
23.	Architectures– Alex Net, VGG, Inception	R5	37	BB	1	23
24.	Inception, Res Net	R5	37	BB	1	24
25.	Training a Convent Weights initialization	R5	38,40	BB	1	25
26.	Batch normalization	R5	25	BB	1	26
27	Hyper parameter optimization.	R5	21	BB	1	27

Outcome of Unit III:

CO 3: Realign high dimensional data using reduction techniques.

- Understand the concepts Linear (PCA, LDA) and manifolds, metric learning
- Gain knowledge about various Alex Net, VGG, Inception, ResNet
- Define normalization

UNIT-IV	**OPTIMIZATION AND GENERALIZATION**				**(9)**	
28	Optimization in deep learning	R5	21	BB	1	28
29.	Non-convex optimization for deep networks	R5	24	BB	1	29
30.	Stochastic Optimization Generalization in neural networks	R5	26	BB	1	30
31	Spatial Transformer Networks	R5	32	BB	1	31
32.	Recurrent networks, LSTM	R5	48	BB	1	32
33.	Recurrent Neural Network Language Models	R5	48	BB	1	33
34.	Word-Level RNNs	R5	47	BB	1	34
35.	Deep Reinforcement Learning	R5	47	BB	1	35
36.	Computational & Artificial Neuroscience	R5	49	BB	1	36

Outcome of Unit IV:

CO4: Analyze the performance of various optimization and generalization techniques in deep learning.

- Understand the concepts of Optimization in deep learning
- Known about spatial Transformer Networks
- Get the knowledge about Deep Reinforcement Learning

UNIT V	CASE STUDY AND APPLICATIONS					(9)
37.	Image Net	W2	-	BB	1	37
38.	Detection-Audio Wave Net	W2,T2	-	BB	1	38
39.	Natural Language Processing Word2Vec	T2	423,463 ,479	BB	1	39
40.	Joint Detection Bioinformatics	T2	504	BB	2	40.41
41.	Face Recognition	T2	528	BB	1	42
42.	Scene Understanding	T2	560	BB	1	43
43	Gathering Image Captions	T2	592	BB	2	44,45

Outcome of Unit V:

CO5: Explore the deep learning applications.

CO6: Develop a real time application using deep learning neural networks

- Understand the techniques involved in Audio Wave Net
- Know about the concept ofJoint Detection Bio Informatics
- Understand the concept of Face Recognition

Course Outcome:

At the end of course:
Students should be able to do:
CO1: Select suitable model parameters for different machine learning techniques.(K2)
CO2: Evaluate the performance of existing deep learning models for various applications. (K2)
CO3: Realign high dimensional data using reduction techniques. (K2)
CO4: Compare the performance of various optimization and generalization techniques in deep learning.(K2)
CO5: Explore the deep learning applications.(K2)
CO6: Develop a real time application using deep learning neural networks. (K3)

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1	-	-	1	-	-	-	-	-	-	-
CO 2	2	1	-	-	1	-	-	-	-	-	-	-
CO 3	2	1	-	-	1	-	-	-	-	-	2	2
CO 4	2	1	-	-	1	-	-	-	-	-	-	-
CO 5	2	1	-	-	1	-	-	-	-	-	2	2
CO 6	3	2	1	1	2	-	-	-	-	-	3	3
Avg	2.17	1.17	1	1	1.17	-	-	-	-	-	2.3	2.3

[Levels of correlation: 3 (High), 2 (Medium), 1 (Low)]

Content beyond Syllabus:

- Large Scale Deep Learning
- Speech Recognition
- Confronting the Partition Function
- Deep Learning solves complex machine learning issues.

Assignment:

Web Portal	Assignment	Components	Topic Number with Topic/Unit Details	Relevance to CO
Web Portal 1	**--**	**Assessment – I (60)**	**Unit I and II**	**CO1 & CO2**
	1	**Assignment-Handwritten (20)**	Comparison of Linear Models and Neural Networks	**CO 1**
	2	**Poster/PPT Presentation (20)**	Evolution of Deep Learning: From Shallow Networks to GANs.	**CO 2**
Web Portal 2	**--**	**Assessment – II (60)**	**Unit III and IV**	**CO3 & CO4**
	3	**Seminar (20)**	Dimensionality Reduction Techniques in Deep Learning	**CO 3**
	4	**Case Study Report/ Mini Project/ Model Making (20)**	Case Study on Face Recognition using Deep Learning	**CO 4**
Web Portal 3	**--**	**Model Exam (75)**	**Unit V**	**CO1 to CO6**
	5	**Technical Aptitude (15)**	Image Net / V Detection-Audio Wave Net / V	**CO 5 & CO 6**
		Attendance (Course attendance-10)		

Submission Details:

Phase 1(Before AT 1)		Phase 2 (Before AT 2)		Phase 3 (Model)
Assignment 1	**Assignment 2**	**Assignment 3**	**Assignment 4**	**Assignment 5**

PLAN OF ASSESSMENT TEST –DISTRIBUTION OF MARKS:

TEST	CO- MARK WISE DISTRIBUTION						BLOOM'S LEVEL MARK WISE DISTRIBUTION					
AT-1	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	37	23	--	--	--	--	20	40	--	--	--	-
AT-2	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	-	-	-	-	-	-	-	-	-	-	-	-
MODEL	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	-	-	-	-	-	-	-	-	-	-	-	-

Google Class Code Details:

Class Name: Deep Learning**:**

Prepared by **Verified By**

Approved By

Principal