

**DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE****(AUTONOMOUS)**

(Approved by AICTE &amp; Affiliated to Anna University, Chennai)

Accredited with 'A' Grade by NAAC, Accredited by TCS

Accredited by NBA with BME, ECE &amp; EEE

**PERAMBALUR - 621 212. Tamil Nadu.**website : [www.dsengg.ac.in](http://www.dsengg.ac.in)**COURSE PLAN (2024-2025 Odd Semester)**

<b>Name of the Faculty</b>				
<b>Designation/Department</b>	Assistant Professor / Information Technology			
<b>Course Code/Name</b>	<b>U20IT702/ DEEP LEARNING</b>			
<b>Year/Section/Department</b>	<b>IV/IT A</b>			
<b>Credits Details</b>	<b>L:3</b>	<b>T: 0</b>	<b>P: 0</b>	<b>C:3</b>
<b>Total Contact Hours Required</b>	<b>45</b>			

**Syllabus:**

<b>UNIT-I INTRODUCTION TO DEEP LEARNING</b>	<b>9</b>
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.	
<b>UNIT-II DEEP NETWORKS</b>	<b>9</b>
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.	
<b>UNIT-III DIMENSIONALITY REDUCTION</b>	<b>9</b>
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – Alex Net, VGG, Inception, ResNet- Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.	
<b>UNITIV OPTIMIZATION AND GENERALIZATION</b>	<b>9</b>
Optimization in deep learning– non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning- Computational & Artificial Neuroscience	
<b>UNIT-V CASE STUDY AND APPLICATIONS</b>	<b>9</b>
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
<b>UNIT I INTRODUCTION TO DEEP LEARNING</b>						<b>(9)</b>
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.

<b>UNIT-II DEEP NETWORKS</b>						<b>(9)</b>
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 Convnet 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 of Joint 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
<b>Web Portal 1</b>	--	<b>Assessment – I (60)</b>	<b>Unit I and II</b>	<b>CO1 &amp; CO2</b>
	1	<b>Assignment-Handwritten (20)</b>	Comparison of Linear Models and Neural Networks	<b>CO 1</b>
	2	<b>Poster/PPT Presentation (20)</b>	Evolution of Deep Learning: From Shallow Networks to GANs.	<b>CO 2</b>
<b>Web Portal 2</b>	--	<b>Assessment – II (60)</b>	<b>Unit III and IV</b>	<b>CO3 &amp; CO4</b>
	3	<b>Seminar (20)</b>	Dimensionality Reduction Techniques in Deep Learning	<b>CO 3</b>
	4	<b>Case Study Report/ Mini Project/ Model Making (20)</b>	Case Study on Face Recognition using Deep Learning	<b>CO 4</b>
<b>Web Portal 3</b>	--	<b>Model Exam (75)</b>	<b>Unit V</b>	<b>CO1 to CO6</b>
	5	<b>Technical Aptitude (15)</b>	Image Net / V Detection-Audio Wave Net / V	<b>CO 5 &amp; CO 6</b>
		<b>Attendance (Course attendance-10)</b>		

**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					
	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
AT-1			--	--	--	--			--	--	--	-
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**

AP/IT

**Verified By**

HOD/IT

**Approved by**

**Principal**