



**DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE**  
(AUTONOMOUS)

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

Re-Accredited by NAAC with 'A' Grade

Accredited by NBA for AERO, BME, CSE, ECE, EEE, IT & MECH.

**PERAMBALUR-621212, TAMILNADU, INDIA.**

Website: [www.dsengg.ac.in](http://www.dsengg.ac.in)



**M.E COMPUTER SCIENCE AND ENGINEERING REGULATIONS – 2023**

<b>Name of the Faculty</b>				
<b>Designation/Department</b>	AP/CSE			
<b>Course Code/Name</b>	<b>P23CST23-DEEP LEARNING</b>			
<b>Year/Section/Department</b>	I/A/CSE			
<b>Credits Details</b>	L: 3	T: 0	P: 0	C:3
<b>Total Contact Hours Required</b>	45			

**Syllabus:**

<b>UNIT I - DEEP LEARNING CONCEPTS</b>	<b>No. of Periods: 9</b>
Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modeling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.	
<b>UNIT II - NEURAL NETWORKS</b>	<b>No. of Periods: 9</b>
About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Over fitting and Under fitting. Hyper parameters.	
<b>UNIT III - CONVOLUTIONAL NEURAL NETWORK</b>	<b>No. of Periods: 9</b>
About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO	
<b>UNIT IV - NATURAL LANGUAGE PROCESSING USING RNN</b>	<b>No. of Periods: 9</b>
About NLP & its Toolkits. Language Modeling. Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co-occurrence Statistics-based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN). Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.	
<b>UNIT V - DEEP REINFORCEMENT &amp; UNSUPERVISED LEARNING</b>	<b>No. of Periods: 9</b>
About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders	

**TOTAL: 45 PERIODS**

**Objectives:**

1. Develop and Train Deep Neural Networks.
2. Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition.
3. Build and train RNNs, work with NLP and Word Embeddings
4. The internal structure of LSTM and GRU and the differences between them
5. The Auto Encoders for Image Processing

**Text Book:**

T1- **Ian Goodfellow, Yoshua Bengio, Aaron Courville**, *Deep Learning*, MIT Press, 2016..  
 T2 - **Francois Chollet**, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021..  
 T3 **Michael Nielsen**, *Neural Networks and Deep Learning*, Determination Press, 2015.

**Reference Book:**

R1. Andrew S. Tanenbaum & David J. Wetherall, *Computer Networks*  
 R2. Douglas E. Comer, *Internetworking with TCP/IP*.  
 R3. Charlie Kaufman, Radia Perlman, Mike Speciner, *Network Security: Private Communication in a Public World*

**Website:**

W1: <https://www.statlect.com/probability-distributions>  
 W2: <https://www.khanacademy.org/math/statistics-probability>  
 W3: <https://stattrek.org/probability/probability-rules.aspx>  
 W4: <https://www.geeksforgeeks.org/probability-in-maths/>

**Online Mode of Study:**

W1: [https://onlinecourses.nptel.ac.in/noc24\\_ma23/preview](https://onlinecourses.nptel.ac.in/noc24_ma23/preview)  
 W2: <https://www.coursera.org/courses?query=probability%20and%20statistics>  
 W3: <https://www.khanacademy.org/math/statistics-probability>  
 W4: <https://stattrek.org/statistics/tutorials.aspx>  
 W5: <https://www.statlect.com/>

**Course Plan:**

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
<b>UNIT I - DEEP LEARNING CONCEPTS</b>						
1	Fundamentals of Deep Learning	T1	1-5	BB	1	1
2	Perceptron Learning Algorithms	T1	6-10	BB	1	2
3	Probabilistic Modeling	T1	11-15	BB	1	3
4	Early Neural Networks	T1	16-20	BB	1	4
5	Differences between	T1	21-25	BB	1	5

	Machine Learning and Deep Communication					
6	Scalars, Vectors, Matrices	T1	26-30	BB	1	6
7	Higher Dimensional Tensors	T1	31-35	BB	1	7
8	Vector, Time Series, Image, Video Data	T1	36-40	BB	1	8
9	Manipulating Tensors	T1	41-45	BB	1	9

**Outcome of Unit I:**

At the end of unit, Students should be able to

- Feature Extraction from Image and Video Data

**UNIT II NEURAL NETWORKS**

10	Introduction to Neural Networks	T1	46-50	BB	1	10
11	Building Blocks	T1	51-55	BB	1	11
12	Optimizers	T1	56-60	BB	1	12
13	Activation Functions	T1	61-65	BB	1	13
14	Loss Functions	T1	66-70	BB	1	14
15	Data Preprocessing	R1	71-75	BB	1	15
16	Feature Engineering	T1	76-80	PPT	1	16
17	Overfitting and Under fitting	T1	81-85	BB	1	17
18	Hyper parameters	T1	86-90	BB	1	18

• **Outcome of Unit II:**

At the end of this unit, students should be able to:

- Implement Image Segmentation and Instance Segmentation in Images.

**UNIT-III - ELEMENTS OF IOT**

19	About CNN	T1	91-95	BB	1	19
20	Linear Time Invariant	T1	96-100	BB	1	20
21	Gateways	T1	101-105	BB	1	21
22	Image Processing Filtering	T1	106-110	BB	1	22
23	Image Processing Filtering	T1	111-115	BB	1	23
24	Convolution Layers	T1	116-120	BB	1	24
25	Pooling Layers	T1	121-125	BB	1	25
26	Dense Layers & Activation Functions	T1	126-130	BB	1	26
27	Backpropagation in CNN	T1	131-135	BB	1	27

• **Outcome of Unit III:**

At the end of this unit, students should be able to:

- Implement image recognition and image classification using a pretrained network

**UNIT-IV- NLP USING RNN**

28	Introduction to NLP	T2	136-140	BB	1	28
29	Cloud computing basics	T2	141-145	BB	1	29

30	NLP Toolkits	T2	146-150	BB	1	30
31	Language Modeling	T2	151-155	BB	1	31
32	Vector Space Model (VSM)	T2	156-160	BB	1	32
33	Word Embedding's (CBOW, Skip-Gram)	T2	161-165	BB	1	33
34	Word2Vec & GloVe	T2	166-170	BB	1	34
35	RNN & Backpropagation Through Time	T2	171-175	BB	1	35
36	LSTM, GRU, Bidirectional RNN	T2	176-180	BB	1	36

**Outcome of Unit IV:**

At the end of this unit, students should be able to:

- Traffic Information analysis using Twitter Data

**UNIT-V - DEEP REINFORCEMENT & UNSUPERVISED LEARNING**

37	Deep Reinforcement Learning	T2	181-185	<b>BB</b>	<b>1</b>	37
38	Q-Learning	T2	186-190	BB	1	38
39	Deep Q-Network (DQN)	T2	191-195	BB	1	39
40	Policy Gradient Methods	T2	196-200	BB	1	40
41	Actor-Critic Algorithm	T2	201-205	BB	1	41
42	Auto encoders	T2	206-210	BB	1	42
43	Convolutional & Denoising Auto encoders	T2	211-215	BB	1	43
44	Variational Auto encoder (VAE) with IoT	T2	216-220	BB	1	44
45	GAN & Applications	T2	221-225	BB	1	45

**Outcome of Unit V:**

At the end of this unit, students should be able to:

- Design Auto encoder for Classification & Feature Extraction
- Apply reinforcement learning algorithm in healthcare system.

**Course Outcome:**

At the end of the course the students would be able to

- CO1:** Feature Extraction from Image and Video Data.
- CO2:** Implement Image Segmentation and Instance Segmentation in Images.
- CO3:** Implement image recognition and image classification using a pretrained network
- CO4:** Traffic Information analysis using Twitter Data
- CO5:** Design Auto encoder for Classification & Feature Extraction
- CO6:** Apply reinforcement learning algorithm in healthcare system.

**Course Outcome Vs Program Outcome Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 2	3	2	1	1	1	-	-	-	-	1	-	2	2	1
CO 3	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 4	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 5	2	1	-	-	-	-	-	-	-	1	1	-	2	1
CO 6	2	1	-	-	1	-	-	-	2	1	1	2	2	1
<b>AVG</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>

**Internal Evaluation Components:**

Web portal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
Web portal 1	--	Assessment – I (60)	Unit I and II	CO 1 & CO2
	1	Assignment – Handwritten (20)	1 Explain the Perceptron Learning Algorithms. 2. Explain Neural Networks .	CO1
	2	Assignment – Poster Presentation / PPT (20)	1. Explain Linear time invariant 2 Explain Pooling layers and its types,	CO2
Web portal 2	--	Assessment – II (60)	Unit III and IV	CO3 & CO4

	3	<b>Seminar (20)</b>	1. Explain vector space model. 2. Explain Natural Language Processing and its applications..	CO3
	4	<b>Case Study Report (20)</b>	1.Explain LSTM architecture and its advantages over RNN... 2. Explain Actor-Critic algorithm with working..	CO4
<b>Web portal 3</b>	--	<b>Model Exam (75)</b>	<b>Unit I to V</b>	<b>CO1 to CO6</b>
	5	<b>MCQ (15)</b>	<b>Unit I to V</b>	<b>CO1 to CO6</b>
	-	<b>Course Attendance (10)</b>	--	--

**Submission Details:**

<b>Phase 1(Before AT 1)</b>	<b>Phase 2 (Before AT 2)</b>	<b>Phase 3(Before Model Exam)</b>
<b>Assignment 1</b>	<b>Assignment 2</b>	<b>Assignment 3</b>

**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	37	23	-	-	-	-						
AT-2	-	-	37	23	-	-						
MODEL	20	20	20	20	10	10						

**Prepared By**

**Verified By**

**Approved By**