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

COURSE PLAN

Course Code/Name	U23CST42/MACHINE LEARNING			
Year/Section/Department	III/A/AI&DS			
Credits Details	**L:3**	**T:0**	**P:0**	**C:3**
Total Contact Hours Required	45			

Syllabus:

UNIT I / PROBLEM SOLVING	**No. of Periods:9**
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)	
UNIT II/ PROBABILISTIC REASONING	**No. of Periods 9**
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	
UNIT III / SUPERVISED LEARNING	**No. of Periods 9**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests	
UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	**No. of Periods 9**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization	
UNIT V NEURAL NETWORKS	**No. of Periods 9**
Perception - Multilayer perception, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper	

parameter tuning, batch normalization, regularization, dropout.

Objective:

- ❖ Study about uninformed and Heuristic search techniques.
- ❖ Learn techniques for reasoning under uncertainty
- ❖ Introduce Machine Learning and supervised learning algorithms
- ❖ Study about ensemble and unsupervised learning algorithms
- ❖ Learn the basics of deep learning using neural networks
- ❖ To understand Undecidability and NP class problems.

Text Book:

T1: SN Sangeetha S Jothimani, "CS3491-Artificial-intelligence-and-machine-learning" Regulations-2021

T2:Tom Mitchell, "Machine Learning", McGraw Hill, 3 rd Edition,1997.

T3:Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

T4: Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014

Website:

W1: https://www.geeksforgeeks.org/artificial-intelligence/
W2: https://pgmpy.org/
W3: https://scikit-learn.org/stable/
W4: https://www.kdnuggets.com/
W5: https://www.tensorflow.org/tutorials

Online Mode of Study:

NPTEL & Coursera details can be listed.

- ❖ https://nptel.ac.in/courses/106/106/106106140
- ❖ https://www.coursera.org/learn/machine-learning
- ❖ https://nptel.ac.in/courses/106/106/106106202
- ❖ https://nptel.ac.in/courses/106/106/106106212

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I –PROBLEM SOLVING						
1	Introduction to AI AI Applications	T1	1.1-1.3	BB	1	1
2	AI Applications	T1	1.4	BB	1	2
3	Problem solving agents	T1, W1	1.7-1.22	BB	1	3
4	Search algorithms	T1	1.25	PPT	1	4
5	Uninformed search strategies	T1, R1	1.29	BB	1	5
6	Heuristic search strategies	T1	1.45	BB	1	6
7	Local search and optimization problems	T1	1.48	PPT	1	7
8	Adversarial search	T1	1.54-1.60	BB	1	8
9	Constraint satisfaction problems (CSP)	T1	1.63	BB	1	9
Outcome of Unit I: **CO1**: Understand fundamental AI concepts, applications, and problem-solving agents. Apply uninformed, heuristic, local search, adversarial strategies, and constraint satisfaction methods to solve AI problems.						
UNIT II - PROBABILISTIC REASONING						
10	Acting under uncertainty	T1, R1	2.1	BB	1	10
11	Bayesian inference	T1	2.4	BB	1	11
12	Naïve bayes models	T1	2.4-2.14	PPT	1	12
13	Naïve bayes models	T1	2.4-2.14	PPT	1	13
14	Probabilistic reasoning	T1	2.15	PPT	1	14

15	Bayesian networks	T1	2.15	BB	1	15
16	Exact inference in BN	T1	2.15-2.22	BB	1	16
17	Approximate inference in BN	T1	2.23-2.29	BB	1	17
18	Causal networks	T1, W2	2.33	BB	1	18
Outcome of Unit II: **CO2:** Gain knowledge of reasoning under uncertainty using Bayesian inference and networks. Implement naïve Bayes models and perform exact and approximate inference in probabilistic models.						
UNIT III – SUPERVISED LEARNING						
19	Introduction to machine learning	T1	3.1-3.4	BB	1	19
20	Linear Regression Models: Least squares, single & multiple variables	T1	3.5-3.16	BB	1	20
21	Bayesian linear regression, gradient descent,	T1	3.18-3.16	BB	1	21
22	Linear Classification Models: Discriminant function , Probabilistic discriminative model	T, R2	3.21-3.23	BB	2	22
23	Logistic regression	T1, W3	3.37	BB	2	23
24	Probabilistic generative model – Naive Bayes,Maximum margin classifier	T1	3.44-3.55	PPT	2	24
25	Support vector machine	T1, R2	3.56-3.58	PPT	2	25
26	Decision Tree	T1, R2	3.16-3.66	PPT	2	26
27	Random forests	T1	3.67-3.79	BB	2	27
Outcome of Unit III: **CO3:** Learn foundational supervised machine learning models like linear regression, logistic regression, SVM, and decision trees. Apply generative and discriminative approaches for classification using various real-world datasets.						

UNIT IV – ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING						
28	Combining multiple learners: Model combination schemes	T1, W4	4.1-4.2	PPT	1	28
29	Combining multiple learners: Voting	T1	4.1-4.3	BB	1	29
30	Ensemble Learning - bagging	T1	4.27-4.31	BB	1	30
31	Ensemble Learning - boosting	T1	4.35-4.40	BB	1	31
32	Ensemble Learning - stacking	T1, W4	4.7-4.12	BB	1	32
33	Unsupervised learning: K-means	T1	4.43-4.52	PPT	2	33
34	Instance Based Learning: KNN	T1	4.64-4.74	PPT	2	34
35	Gaussian mixture models	T1	4.83-4.89	BB	2	35
36	Expectation maximization	T1	4.89-4.98	BB	1	36
Outcome of Unit IV: **CO4:** Understand model combination techniques such as bagging, boosting, and stacking in ensemble learning. Explore unsupervised learning methods including K-means, KNN, Gaussian mixtures, and EM algorithm.						
UNIT V – NEURAL NETWORKS						
37	Introduction to Perception And Multilayer perception	T1, W4	5.1-5.4	BB	1	37
38	Activation functions	T1	5.27-5.28	BB	1	38
39	Network training and Fundamentals	T1	5.41-5.47	BB	1	39
40	Gradient descent optimization	T1	5.47-5.54	BB	1	40
41	Error Backpropagation	T1	5.54-5.61	BB	1	41
42	Shallow Networks to Deep Networks	T1	5.61-5.69	BB	1	42
43	Unit Saturation and Vanishing Gradient Problem	T1	5.69-5.73	BB	1	43

44	ReLU, Regularization Techniques	T1	5.73-5.76	BB	1	44
45	Hyper Parameter tuning, Batch Normalization	T1	5.76-5.86	BB	1	45

Outcome of Unit V:

CO5: Learn architecture and training of neural networks including backpropagation and gradient descent. Apply deep learning techniques using ReLU, dropout, batch normalization, and hyperparameter tuning.

Course Outcome:

At the end of course: Students should be able to do:
CO 1:Make Use of appropriate search algorithms for problem solving
CO 2:Apply reasoning under uncertainty
CO 3:Build supervised learning models
CO 4:Build ensemble and unsupervised models
CO 5:Build deep learning neural network models
CO 6:Explain gradient descent optimization

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1	2	-	-	-	-	-	-	-	-	-
CO 2	2	3	1	-	-	-	-	-	-	-	-	-
CO 3	1	2	1	-	-	-	-	-	-	-	-	-
CO 4	1	1	2	-	-	-	-	-	-	-	-	-
CO 5	1	3	1	-	-	-	-	-	-	-	-	-
AVG.	1.4	2.0	1.4	-	-	-	-	-	-	-	-	-

Content beyond Syllabus:

- Explainable AI
- AI Tools & Frameworks

Internal Evaluation Components:

Web portal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
	--	**Assessment – I (60)**	**Unit I and II**	**CO 1 & CO2**

Webportal 1	**1**	**Assignment – Handwritten (20)**	5. Compare uninformed and informed (heuristic) search strategies with examples. 8. Design a Tic-Tac-Toe AI using Minimax Algorithm Instructions in Processor 12. Naïve Bayes Classification 15. Bayesian networks inference	**CO 1 & CO2**
	2	**Assignment – Poster Presentation / PPT (20)**	1. Difference between AI and ML with app, adv, disadv, example(min 15 points) 7. Local Search and Optimization Techniques 18. Causal Networks in AI	**CO 1 & CO2**
Webportal 2	**--**	**Assessment – II (60)**	Unit III and IV	**CO3 & CO4**
	3	**Seminar (20)**	25. Support vector machine 26. Decision Tree 27. Random Forests 30. Ensemble Learning – bagging, boosting, stacking	**CO3 & CO4**
	4	**Case Study Report (20)**	20.(a) Simple Linear Regression Models (b) Linear Regression using Least Squares method 33. K-means clustering 34. K-Nearest Neighbor(KNN) 35. Difference between GMM and K-means(min 10 points)	**CO3 & CO4**
Webportal 3	**--**	**Model Exam (75)**	**Unit I to V**	**CO1 to CO6**
	5	**MCQ (15)**	**Unit I to V**	**CO1 to CO6**
	-	**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**

Google Class Code Details: 66o7ym4
Class Name: III AIDS

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**
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**

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