UE18CS303: Machine Intelligence(4:0:0:0:4)

#of Credits:4 **#of Hrs: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion Covered	
			% of Syllabus	Cumulative %
Unit 1 :Introduction & Basics				
1		Introduction to AI and ML	21.4	21.4
2		Intelligent Agents and its Types		
3		Machine Learning and its Models		
4	**T1 1.1**	Problem solving by Searching- Uninformed Search		
5	**T1 1.2**	Problem solving by Searching- Informed Search		
6	**T1 3.3-3.4**	Perspectives and Issues, designing learning systems		
7	**T1 3.5-3.6**	Concepts of hypotheses, Version space, inductive bias		
8	**T2 1.2-1.3** **T2 2.1-2.4,2.7**	Performance metrics-accuracy, precision, recall, sensitivity, specificity, AUC, RoC		
9		Decision Trees- Basic algorithm (ID3)		
10	**T2 3.1-3.7**	Hypothesis search and Inductive bias, Entropy and Gain calculations		
11		Issues in Decision Tree Learning – Overfitting		
12		Solutions to overfitting, Dealing with continuous values		

Unit 2 : Classification and Regression				
13	**T2 :Ch8:Pages 230-238, Ch4:Pages 81-105, 108-111 R1 Ch7.3**	Instance-based learning: k-nearest neighbor learning	21.4	42.8
14		Simple problems – weighted KNN		
15		Issues with KNN – discussion		
16		Artificial Neural networks: Introduction		
17		Perceptrons – implementing LOGIC gates		
18		Multi-layer networks and back-propagation		
19		Back-propagation derivation		
20		Activation Units – discussion		
21		Support Vector Machines – margin and maximization		
22		SVM - The primal problem, the Lagrangian dual		
23		SVM – Solution to the Lagrangian dual		
24		Simple problems on SVM		
Unit 3 : Stochastic Learning				
25	**R4: Pages 129-133, T2: Ch6 – Pages 154-166, 170-171, 174-182, R3 - Ch13**	Improving performance: Bagging and Boosting	21.4	64.2
26		Adaboost - combining weak learners		
27		Bayesian Learning – Bayes theorem, Concept learning		
28		Maximum likelihood, Bayes optimal classifier		
29		Naïve Bayes classifier and text classification.		
30		Expectation Maximization Algorithm		
31		Expectation Maximization Algorithm		
32		Gaussian Mixture Models		
33		Hidden Markov models – discrete Markov processes		
34		Hidden Markov models – 3 basic problems		
35		Learning the state sequence		
36		Learning the parameters, Baum-Welch Algorithm		

Unit 4 : Unsupervised Learning and Dimensionality Reduction				
37	**R4: Ch10: Pages 207-217,Ch11: Pages 224-234, Ch12:Pages 248-260, Course Notes**	Unsupervised Learning: Hierarchical vs non-hierarchical clustering, Agglomerative and divisive clustering	18	82.2
38		K-means clustering, Simple problems		
39		Bisecting k-means, issues with k-means.		
40		K Means as special case of Expectation Maximization		
41		Apriori algorithm - Association analysis, the Apriori principle.		
42		Finding frequent itemsets, mining association rules		
43		FP-growth – FP trees, building an FP-tree		
44		Mining frequent items from an FP-Tree		
45		Dimensionality reduction techniques PCA		
46		SVD – Applications.		
Unit 5 : Genetic Algorithms and Computational Learning Theory				
47	T2: Ch7.1-7.4,Ch9,Course Notes	Genetic Algorithms – Representing hypothesis, Genetic operators	17.8	100
48		Fitness function and selection methods, crossover, mutation		
49		Simple applications of the Genetic Algorithm, application of GA in Decision tree		
50		Genetic Algorithm based clustering		
51		Single Objective and Bi-objective optimization problems using GA		
52		Using GA to emulate Gradient descent/ascent		
53		Introduction to PSO		

54		Application in Single Objective optimization problems		
55		Computational Learning Theory, PAC-Learnability		
56		The Vapnik-Chervonenkis Dimension		

Literature:

Book Type	**Code**	**Author & Title**	***Publication info***		
			Edition	**Publisher**	**Year**
Text books	T1	Artificial Intelligence: A Modern Approach by Stuart Russel and Peter Norvig	3rd	Pearson	2009
	T2	Machine Learning by Tom Mitchell,	Indian Edition	McGraw Hill Education (India)	1997

Book Type	**Code**	**Author & Title**	***Publication info***		
			Edition	**Publisher**	**Year**
Reference books	R1	Machine Learning The Art and Science of Algorithms that Make Sense of Data by Peter Flach	1st editon	Cambridge University Press	2012
	R2	Pattern Recognition and Machine Learning by Christopher Bishop	2nd printing	springer	2011

	R3	Introduction to Machine Learning by Ethem Alpaydin	2nd Edition	PHI Learning	2019
	R4	Machine Learning in Action by PETER HARRINGTON	1st	Manning	2012