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

#of Credits:4 #of Hrs: 56

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

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| --- | --- | --- | --- | --- | --- |
| **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 |

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| **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 |