| MACHINE LEARNING | | | |
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| **Course Code:** | **CS405** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **4U** | **Course Semester (U / P):** | **7U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
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| 1. Explain Machine Learning concepts, classifications of Machine Learning and write simple programs using python. |
| 2. Describe Supervised Learning concepts. |
| 3. Describe unsupervised learning concepts and dimensionality reduction techniques |
| 4. Discuss simple Machine Learning applications in a range of real-world applications using Python programming |
| 5. To develop skills of using recent machine learning software for solving practical problems. |

| **COURSE OUTCOMES** |
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| At the end of the course the students should be able to: |
| 1. Recognize the characteristics of machine learning that make it useful to real-world problems. |
| 2. Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised. |
| 3. Effectively use machine learning toolboxes. |
| 4. Understand the concept behind neural networks for learning non-linear functions. |
| 5. Understand algorithms for learning Bayesian networks |

**Unit 1: Introduction** – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

**Unit 2: Decision** Tree Learning - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline,Multilayer networks, Derivation of backpropagation rule Backpropagation Algorithm Convergence, Generalization

**Unit 3: Evaluating Hypotheses:** Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms;
**Bayesian Learning:** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;

**Unit 4: Computational Learning Theory:** Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning;
INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

**Unit 5: Genetic Algorithms:** an illustrative example, Hypothesis space search, Genetic

Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms- General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q
Learning.

**Text Books:**

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.