**20CS41O2** - **MACHINE LEARNING**

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| **Course category:** | Program Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0- 0 |
| **Prerequisite:** | Probability Theory and Linear Algebra. | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected: | |
| 1. To introduce fundamental concepts in machine learning and popular machine learning algorithms. 2. To become familiar with the fundamentals of Supervised Learning techniques 3. To understand & analyze various Unsupervised Learning techniques. 4. To acquire knowledge on principles and techniques of Artificial Neural Networks. 5. To understand different types of Perceptron. 6. To have a profound understanding of Computational Learning Theory. | |
| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | Understand the fundamental principles, techniques and applications of Machine Learning. |
| CO2 | Design and implement machine-learning solutions to classification, regression and clustering problems. |
| CO3 | Evaluate and interpret the results of the Unsupervised Learning techniques. |
| CO4 | Design the neural network to meet the needs of control systems and pattern classification issues. |
| CO5 | Recognize and implement various ways of selecting suitable model parameters for different Machine Learning techniques. |
| CO6 | Gain the knowledge of Computational Learning Theory. |
| **Course**  **Content**  **Course**  **Content** | **UNIT – I**  **MACHINE LEARNING**: Introduction, Review of Probability Theory and Linear Algebra, Basic definitions of machine learning, types and applications of machine learning, hypothesis space and inductive bias, evaluation, cross-validation.  **UNIT - II**  **SUPERVISED LEARNING:** Introduction, Linear methods for classification, Linear methods for regression, Support Vector Machine, SVM- the dual formulation, SVM- the maximum margin with noise, Decision trees, over fitting.  **UNIT – III**  **UNSUPERVISED LEARNING:** Introduction, Instance based learning: K- Nearest neighbour, Feature selection, Feature Extraction, Collaborative filtering-based recommendation, Bayesian learning, Naïve Bayes, Bayesian network, Kernel functions, Non-linear SVM with kernel function.  **UNIT – IV**  **NEURAL NETWORKS:** Introduction, Biological neurons, Artificial neurons, Mc.Culloch-Pitts model, Neuron Modelling for artificial neural systems, Feed forward network, Feedback network, Types of neural networks.  **UNIT – V**  **PERCEPTRON:** Introduction, Exclusive OR problem, Single layer perceptron network, Multilayer feed forward networks, Pattern classification, Delta learning rule for multilayer perceptron, Error back propagation algorithm.  **UNIT - VI**  **COMPUTATIONAL LEARNING THEORY:** Introduction, PAC learning model, Sample complexity, VC Dimension, Ensemble learning, Introduction to Clustering, k-means clustering, adaptive hierarchical clustering. | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. Mitchell Tom, Machine Learning, McGraw Hill, 1997. 2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer 2006. 3. Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publications.   **REFERENCE BOOKS:**   1. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification (2nd edition). Wiley, New York, 2001. 2. Nikola K.Kasabov, Foundations of Neural Networks, Fuzzy Systems and Knowledge Engineering (The MIT Press) | |
| **E-Resources** | 1. https://onlinecourses.nptel.ac.in/noc18\_cs40 2. <http://nptel.ac.in/courses/108104049/13> | |

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| Contribution of Course Outcomes towards achievement of Program Outcomes | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
| CO1 | 3 | 3 | 2 | 2 | **-** | **-** | **-** | **1** | **-** | **-** | **-** | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | **-** | **-** | **-** | 1 | **-** | **-** | **-** | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 1 | **-** | **-** | **-** | 1 | **-** | **-** | **-** | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | **-** | **-** | **-** | 1 | **-** | **-** | **-** | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | **-** | **-** | **-** | 1 | **-** | **-** | **-** | 2 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 3 | **-** | **-** | - | 1 | **-** | **-** | **-** | 2 | 2 | 2 |