**Introduction to Machine Learning**

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| **Teaching Scheme:** | **Examination Scheme:** |
| **Lectures : 3 Hrs/week** | **T1 and T2: 20 Marks each**  **End-Sem Exam: 60 Marks** |

**Course Outcomes:**

This course will serve as a comprehensive introduction to diverse topics in machine learning. Students will be able to

1. Learn to write computer programs to solve Mechanical Engineering problems.
2. Understand Mathematics needed for Machine Learning.
3. Understand Data Science workflows such as Data Pre-processing and Visualization.
4. Understand machine learning techniques of Regression, Classification and Clustering.
5. Apply Machine Learning to real-world Mechanical Engineering problems datasets.

**Unit I: Python Programming**

Overview. Setup. Syntax, Data Types, Operators: Numerical, Logical. Lists, Tuples, Dictionaries, Sets, Conditionals, Loops. Functions, Anonymous functions. Exceptions, Object oriented programming, Class, File IO, Libraries: Scientific, Plotting, Pandas.

**[9 hrs]**

**Unit II: Mathematics for Machine Learning**

Linear Algebra: Matrix Operations, Projections, Eigenvalues & Eigenvectors, Vector Spaces. Statistics: Random Variables, Variance and Central Tendency. Standard Distributions. Probability. Differential Calculus, Partial Derivatives. Optimization. Sampling Theory.

**[6 hrs]**

**Unit III: Fundamentals of Machine Learning**

Why Machine learning, Examples of Machine Learning Problems, Supervised and unsupervised problems. Training versus Testing, Machine learning Models, Features: feature types, Feature Construction and Transformation, Feature Selection. Cost function. Evaluation metrics. Gradient Descent. **[3 hrs]**

**Unit IV: Supervised Algorithms in Machine learning**

Linear Regression, Logistic Regression, Decision Tree, Ensemble and Random Forest,

Support Vector Machines, Naïve Bayes, K nearest neighbour

**[9 hrs]**

**Unit V: Unsupervised Algorithms in Machine learning**

K-means, Principal Component Analysis,

**[6 hrs]**

**Unit VI: Project**

End-to-end project implementation

**[3 hrs]**

**Text Books**

1. Andreas Muller; "Introduction to Machine Learning with Python: A Guide for Data Scientists"; Shroff/O'Reilly; First edition (2016); ISBN-13: 978-9352134571
2. Sebastian Raschka; "Python Machine Learning"; Packt Publishing Limited (23 September 2015); ISBN-13: 978-1783555130

**Reference Books**

1. Toby Segaran, "Programming Collective Intelligence"; Shroff; First edition (2007), ISBN-13: 978-8184043709
2. Peter Harrington; "Machine Learning in Action"; Dreamtech Press (2012), ISBN-13: 978-9350044131
3. Tom M. Mitchell; "Machine Learning", McGraw Hill Education; First edition (1 July 2017), ISBN-13: 978-1259096952