PHY5043 **Machine Learning for Physicists**

Course Code	PHY5043	Semester	
Course Title	*Machine Learning for Physicists*		
Credits	3	Type	Elective

Course Outcome

The aim of this course is to familiarise students to the areas of artificial intelligence which are useful in computational physics, and in their application in software industry. Students acquire practical skills needed in moving to fields outside physics, especially in data science, and it enhances their employability. Topics included are, but not limited to, the following.

Course Structure

1. Overview of machine learning and AI. 2. Overview of computational aspects of optimisation, linear algebra and statistics.3. Methods of regression and applications 4. Introduction to neural networks, and training data with back propagator algorithms 5. Support vector machines and classification 6. Unsupervised learning, k-Means algorithm, dimensionality reduction and principal component analysis 7. Application to Ising model and other examples from physics 8. Hands-on practice using Matlab, or Python tools, and standard data sets.

Suggested Books

1. Trevor Haste, et.al., *The Elements of Statistical Learning,* Springer (2008)

2. Aurelien Geron, *Hands-on Machine Learning with Scikit-Learn and Tensor Flow*, O'Reilly (2017)

3. Joel Franklin, *Computational Methods for Physics*, Cambridge (2013)

4. Pankaj Mehta, "A high bias low-variance introduction to Machine Learning for physicists", *Physics Reports,* (2019) 1-124