1.	Title of the course	Statistical Learning: Theory and Applications
2.	Course number	MA629L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To MA6040/16
6.	To be offered by	Department of Mathematics and Statistics
7.	To take effect from	July 2022
8.	Prerequisite	CoT
9.	**Course Objective(s):** To introduce statistical concepts and techniques required for machine learning and statistical pattern recognition. To implement the methods on practical problems through a hands-on exercise.	
10.	**Course Content:** Overview of nearest neighbor, decision theory, roughness penalty regression, Bayesian method; Linear and quadratic discriminant analysis, regularized logistic regression, separating hyperplanes; Basis expansion and regularization: splines, filtering, and feature extraction, bias-variance trade-off; Kernel smoothing methods: kernel density estimation and classification, naive Bayes classifier, radial functions; Model assessment and selection: AIC, BIC, VC dimension, cross-validation, bootstrap; Regression tree, classification tree; Neural network: multi-layer perceptron, feed-forward and recurrent networks, self organizing map; Support vector machines, data depths; Cluster analysis: K means clustering, independent component analysis; Random forest.	
11.	**Textbook(s):** 1. Hastie T, Tibshirani R and Friedman J, *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, 2nd Edition, Springer (2013). 2. Webb A R, *Statistical Pattern Recognition*, 3rd Edition, Wiley (2011).	
12.	**Reference(s):** 1. Devroye L, Gyorfi L and Lugosi G, *A Probabilistic Theory of Pattern Recognition*, 1st Edition, Springer (1996). 2. Duda R O, Hart P E and Stork D G, *Pattern Classification*, 2nd Edition, Wiley (2011). 3. Haykin S, *Neural Networks: A Comprehensive Foundation*, 2nd Edition, Pearson Prentice Hall (1999). 4. Vapnik V N, *The Nature of Statistical Learning Theory*, 2nd Edition, Springer (2000).	