1.	Title of the course	Machine Learning in Process Engineering
2.	Course number	CH510L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To CH5030/17
6.	To be offered by	Department of Chemical Engineering
7.	To take effect from	July 2022
8.	Prerequisite	CoT
9.	**Course Objective(s):** To introduce machine learning principles for process data analytics, discuss different classes of learning models, and demonstrate their uses in process engineering applications.	
10.	**Course Content:** Introduction to machine learning in process engineering; Types of process data in the chemical industry and its challenges; Unsupervised learning: cluster analysis - k-means, heirarchical clustering, principal component analysis - probabilistic variants, fault diagnosis applications using Tennesse Eastman dataset, model identification using simulated flow network data; Importance of domain knowledge, model interpretability; Supervised learning: regression and classification, kernel methods, neural networks, hidden Markov models, model assessment and selection, soft sensing in a debutanizer column, process monitoring using multiphase flow dataset; Reinforcement learning: Markov decision process, value function, optimal policy, Q-learning, optimizer, controller, process control and optimization applications in reaction systems.	
11.	**Textbook(s):** 1. Hastie T, Tibshirani R and Friedman J, *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd Edition, Springer (2009). 2. Murphy K P, *Machine Learning: A Probabilistic Perspective*, 1st Edition, The MIT Press (2012).	
12.	**Reference(s):** 1. Bishop C M, *Pattern Recognition and Machine Learning*, 1st Edition, Springer (2006). 2. Mavrovouniotis M L, *Artificial Intelligence in Process Engineering*, 1st Edition, Academic Press (1990). 3. Sutton R S and Barto A G, *Reinforcement Learning*, 2nd Edition, The MIT Press (2018).	