

1.	Title of the course	Optimization for Machine Learning
2.	Course number	CH525L
3.	Structure of credits (L-T-P-C)	3-0-0-3
4.	New course/modification to	New
5.	To be offered by	Chemical Engineering
6.	Proposed by	M Nabil
7.	Prerequisite	CoT
8.	Course Objective(s): To introduce optimization problems in machine learning, discuss various optimization algorithms and demonstrate their merits and demerits.	
9.	Course Content: Basics: convex sets, functions, conjugates, duality, optimality conditions; Optimization formulations in machine learning: supervised, unsupervised, reinforcement learning; First-order methods: gradient descent, stochastic gradient descent, Nesterov acceleration, adaptive learning rate, variance reduction methods, alternating direction method of multipliers, Frank-Wolfe method; Higher order methods: conjugate gradient, quasi Newton and its stochastic variant, Hessian free method; Bayesian optimization; Optimization in deep neural networks; Optimization in variational inference.	
10.	Textbook(s): 1. Kochenderfer M J and Wheeler T A, Algorithms for Optimization, MIT Press (2019).	
11.	Reference(s): 1. Sra S, Nowozin S and Wright S (eds), Optimization for Machine Learning, MIT Press (2011). 2. Boyd S and Vandenberghe L, Convex Optimization, Cambridge University Press (2004). 3. Nocedal J and Wright S, Numerical Optimization, 2nd Edition, Springer (2006).	