1.	Title of the course	Principles of Reinforcement Learning
2.	Course number	CS603L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To CS6021/17
6.	To be offered by	Department of Computer Science and Engineering
7.	To take effect from	July 2022
8.	Prerequisite	CoT
9.	**Course Objective(s):** To study the mathematical concepts towards understanding various elements of reinforcement learning and associated stochastic decision processes. To gain intuition behind the computational aspects of reinforcement learning algorithms.	
10.	**Course Content:** Review of probability, random variables and their convergence, stochastic processes, expectation, conditional expectation, sufficient statistics, martingales; Introduction to real analysis; Sequences of functions: MCT and BCT; Markov chains: mixing times and HMM; Bergman loss functions; Dynamical system: fixed point and stability theorems; Monotonicity and contraction properties of dynamic programming, submodularity, stochastic and monotone likelihood ratio dominance; Stochastic approximation; Sample complexity; Concentration of measure: Tail probabilities, Markov inequality, Chebyshev inequality, Cramer-Chernoff method, Azuma-Hoeffdingâ€™s inequality, Cauchy-Schwarz inequality; Occamâ€™s razor bound; VC dimension.	
11.	**Textbook(s):** 1. Agarwal A, Jian N,Kakade S M and Sun W, *Reinforcement Learning: Theory and Algorithms*, 1st Edition, Research Monograph Draft (2020). 2. Krishnamurthy V, *Partially Observed Markov Decision Processes: From Filtering to Controlled Sensing*, 1st Edition, Cambridge (2016).	
12.	**Reference(s):** 1. Bertsekas D P, *Dynamic Programming and Optimal Control , Vol II*, 4th Edition, Athena Scientific (2012). 2. Borkar V S, *Stochastic Approximation: A Dynamical Systems Viewpoint*, 1st Edition, Hindustan Book Agency (2009). 3. Hajek B, *Random Processes for Engineers*, 1st Edition, Cambridge (2015). 4. Shwartz S S and David S B, *Understanding Machine Learning: From Theory to Algorithms*, 1st Edition, Cambridge (2015).	