

Syllabus of **Reinforcement Learning and Autonomous Systems – AI**
4102

Credits: 3

Contents

Module-1 (5 hours): Introduction to the subject, Environments, Agents, Actions, Policies.

Multi-Armed Bandit (MAB), Application of MAB, Developing reward functions, Strategies for balancing exploration and exploitation, Algorithms for MAB, contextual bandits.

Module-1 continued (3 hours): Theoretical topics related to reinforcement learning. Regret optimality, Concentration bounds, convergence analysis of UCB algorithm, Gittins Index. (touched on the highlighted topics in grey only partially)

Module-2 (8 hours): Markov Decision Process with examples, State Transition Table. Utilities of sequences of Actions and Paths. Optimal Policies. Bellman Equation. Dynamic programming. Value and Policy Iteration Algorithms, Partial Observability.

Monte Carlo methods. Taxonomy: Model based and Model free, Value based and Policy based, On-Policy and Off-Policy, Episodes, Exploration and Exploitation.

Module-3 (8 hours): Temporal Difference Schemes, implementation under On-Policy and Off-Policy conditions, SARSA and Q-Learning.

Actor-Critic methods. Inverse Reinforcement Learning.

Module-4 (8 hours): Deep-Q Learning: implementing Reinforcement Learning using ANN frameworks. Replay memory. Training Deep-Q Networks. Architectures and Algorithms. Development Environments. Applications under different Scenarios.

Module-5 (8 hours): Applications of RL to Robotics and Autonomous Systems: simultaneous localization and mapping (SLAM), depth from monocular cameras, traditional and deep-learning based SLAM, motion planning, and exploration. Introduction to Multi-agent systems.

Books as aides to understanding:

- Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig. [\[Link\]](#)
- Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition. [\[Link\]](#)
- Deep Reinforcement Learning Hands On, Maxim Lapan, 2nd Edition. [ISBN 978-1-83882-699-4].