



**University of Tehran**  
**School of Electrical and Computer Engineering**

<b>Course:</b>	<b>8101501 – Machine Learning.</b>											
<b>Course type:</b>	EE*					CE*					Credit:  3	
		Com	E	P	B	Con	D	SW	HW	IT		MI
	Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>
Elective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>Level:</b>	Undergraduate <input type="checkbox"/> Graduate <input checked="" type="checkbox"/>											
<b>Co-requisite(s):</b>	None.											
<b>Prerequisite(s):</b>	Statistics and Probability (8101092)											
<b>Prerequisite by topic:</b>	None.											
<b>Textbook(s):</b>	[1] Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. The MIT Press, 2016 [2] Szepesvári, Csaba. "Algorithms for reinforcement learning." Morgan and Claypool (2009). [3] Glimcher, P.W. and Fehr, E. and Camerer, C. and Poldrack, R.A , Neuroeconomics: Decision Making and the Brain, Elsevier, 2008. [4] Olson M., Hergenbahn B.R. , An Introduction to the Theories of Learning (9th edition), Prentice-Hall, 2012.											
<b>Coordinator:</b>	Dr. Nili Ahmadabadi, Professor, School of ECE.											
<b>Goals:</b>	Understanding how the living agents interactively learn is of prime importance for creation of artificial systems; that adapt to the natural creatures and learn to improve the services they give to their users. Also, developing interactive learning methods to produce general AI is essential for creating learning artificial systems for diversity of tasks and environments. The goal of this course is to learn these two topics in a unified mathematical and computational view. The focus is on value-based decision making and reinforcement learning methods in discrete and continuous environments as well as on modeling learning behavior.											
<b>Outcome:</b>	Upon successful completion of the course, students will be able to <ol style="list-style-type: none"> <li>1. model human and animal learning and decision making behavior;</li> <li>2. do statistical analysis of learning and decision making behavior;</li> <li>3. formulate optimization and learning tasks into reinforcement learning problems;</li> <li>4. develop and employ a diversity of reinforcement learning methods in</li> </ol>											

**Commented [MN1]:** This is elective for SW and Com as well I think. Pl double check.

**Commented [H2]:** In the official charts of both fields, it's not mentioned.

	4.1. discrete MDP environments, 4.2. continuous MDP environments, 4.3. discrete POMDP environments; 5. mathematical and computational analyze of new reinforcement learning methods; 6. improve the existing reinforcement learning methods.
<b>Topics:</b>	1- Introduction to human decision making methods in individual and social context; 2- Introduction to human decision biases; 3- Reinforcement learning algorithms in single-step tasks; 4- Statistical analysis and modeling of learning behavior; 5- Markov models for discrete and continuous environments; 6- Dynamic programming methods in discrete MDP; 7- Reinforcement learning methods in discrete MDP; 8- Reinforcement learning methods in continuous MDP; 9- Deep reinforcement learning methods; 10- Introduction to hierarchical reinforcement learning; 11- Introduction to reinforcement learning in partial MDP;
<b>Computer usage:</b>	Implementing the projects using Matlab or Python Software.
<b>Assignments:</b>	5 homeworks, including algorithm implementation and behavior modeling.
<b>Projects:</b>	Arbitrary topic related to the course.
<b>Grading:</b>	Assignments: 20% Projects: 20% Midterm exams: 30% Final exam: 30%
<b>Further readings:</b>	Some state of the art papers on learning in SMDP, POMDP, and continuous environments.
<b>Prepared by:</b>	Dr. Majid Nili Ahmadabadi.
<b>Date:</b>	September, 21, 2017.

*EE: Electrical Engineering		CE: Computer Engineering	
Com	Communications	SW	Software
E	Electronics	HW	Hardware
P	Power	IT	Information Technology
B	Bioelectronics	MI	Machine Intelligence and Robotics
Con	Control		
D	Digital System		