YAŞAR UNIVERSITY
COURSE SYLLABUS

Graduate School/Faculty/School	Faculty of Engineering					
Department/Program	Software Engineering Department					
Course Title	**Course Code**	**Semester**	**Course Hour/Week**		**Yaşar Credit**	**ECTS**
			Theory	**Practice**		
Introduction to Reinforcement Learning	SE 4488		3	0	3	6
Course Type						
1. Compulsory Courses						
2. Program Elective Courses						**X**
3. Prerequisites Courses						
4. Course Adaptation						

Language of Instruction	English
Level of Course	Graduate (Second Cycle)
Special Pre-Conditions of the Course (recommended)	

Course Coordinator	Asst.Prof.Dr. Dindar ÖZ
Course Instructor(s)	Asst.Prof.Dr. Dindar ÖZ
Course Assistant(s)/Tutor (s)	
Aim(s) of the Course	The aim of the course is to demonstrate the theoretical foundations and the applications of Reinforcement Learning methods
Learning Outcomes of the Course	1. Ability to build a Reinforcement Learning system for sequential decision making. 2. To understand how to formalize your task as a Reinforcement Learning problem, and how to begin implementing a solution. 3. To Understand the basic space of RL algorithms (Temporal- Difference learning, Monte Carlo, Sarsa, Q-learning, Dyna, and more) 4. To understand how RL fits under the broader umbrella of machine learning
Course Content	Reinforcement Learning is a subfield of Machine Learning, but is also a general purpose formalism for automated decision-making and AI. This course introduces studentst to statistical learning techniques where an agent explicitly takes actions and interacts with the world. Understanding the importance and challenges of learning agents that make decisions is of vital importance today, with more and more companies interested in interactive agents and intelligent decision-making. The course contains fundamental concepts as listed: - Formalization of problems as Markov Decision Processes - Basic exploration methods and the exploration/exploitation tradeoff - Value functions, as a general-purpose tool for optimal decision-making

	- Application of dynamic programming as an efficient solution approach to an industrial control problem - Temporal-Difference learning and Monte Carlo as two strategies for estimating value functions from sampled experience - Exploration methods in DP - Expected Sarsa and Q-learning (two TD methods for control) - Planning with simulated experience (as opposed to classic planning strategies) - Model-based approach to RL, called Dyna, which uses simulated experience

COURSE OUTLINE/SCHEDULE (Weekly)			
Week	**Topics**	**Preliminary Preparation**	**Methodology and Implementation (theory,practice, assignment etc)**
1	Introduction to Sequential Decision Making	Reading	Theory and assignments
2	Introduction to Sequential Decision Making	Reading	Theory and assignments
3	Markov Decision Processes	Reading	Theory and assignments
4	Markov Decision Processes	Reading	Theory and assignments
5	Value Functions & Bellman Equations	Reading	Theory and assignments
6	Dynamic Programming	Reading	Theory and assignments
7	Dynamic Programming	Reading	Theory and assignments
8	Monte Carlo Methods for Prediction & Control	Reading	Theory and assignments
9	Monte Carlo Methods for Prediction & Control	Reading	Theory and assignments
10	Temporal Diff. Learning Methods for Prediction	Reading	Theory and assignments
11	Temporal Diff. Learning Methods for Prediction	Reading	Theory and assignments
12	Temporal Diff. Learning Methods for Control	Reading	Theory and assignments
13	Temporal Diff. Learning Methods for Control	Reading	Theory and assignments
14	Planning	Reading	Theory and assignments

Required Course Material (s) /Reading(s)/Text Book (s)	Reinforcement Learning: An introduction (Second Edition) by Richard S. Sutton and Andrew G. Barto
Recommended Course Material (s)/Reading(s)/Other	

ASSESSMENT		
Semester Activities/ Studies	**NUMBER**	**WEIGHT in %**
Mid- Term	1	%25
Participation		
Quiz		
Assignment (s)	3	%30
Project		
Laboratory		
Field Studies (Technical Visits)		
Presentation/ Seminar		
Practice (Laboratory, Virtual Court, Studio Studies etc.)		
Other (Placement/Internship etc.)		
Final Exam	1	%45

TOTAL		**100**
Contribution of Semester Activities/Studies to the Final Grade		55
Contribution of Final Examination/Final Project/ Dissertation to the Final Grade	1	45
TOTAL		**100**

CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME OUTCOMES							
No	Programme Outcomes	**Level of Contribution (1- lowest/ 5- highest)**					
		1	2	3	4	5	
1	Adequate knowledge accumulation in mathematics, science and software engineering specific issues; the theoretical and practical knowledge in these areas, the ability to use in complex engineering problems.				X		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply appropriate analysis and modeling methods for this purpose.				X		
3	Ability to design a complex system, process, device or product to meet specific requirements under realistic constraints and conditions; ability to apply modern design methods for this purpose.				X		
4	Ability to develop, select and use modern techniques and tools for the analysis and solution of complex problems encountered in engineering applications; ability to use information technologies effectively.			X			
5	An ability to design, conduct experiments, collect data, analyze and interpret results for the study of complex engineering problems or research-specific research topics		X				
6	Ability to work effectively in disciplinary and multidisciplinary teams; individual study skills.			X			
7	Ability to communicate effectively in verbal and written Turkish; at least one foreign language knowledge, at least at the European Language Portfolio B1 Level; writing active reports and writing reports, preparing design and production reports, making effective presentations, giving and receiving clear and understandable instructions.						
8	Awareness of the necessity of lifelong learning; ability to access information, to follow developments in science and technology and to renew himself continuously.						
9	To act in accordance with ethical principles, professional and ethical responsibility; Information on the standards used in engineering applications.						
10	Information on business practices such as project management, risk management and change management; awareness of entrepreneurship and innovation; information about sustainable development.						
11	Knowledge of the effects of engineering practices on health, environment and safety in the universal and social dimensions and the problems of the era in engineering; awareness of the legal consequences of engineering solutions						

ECTS /STUDENT WORKLOAD				
ACTIVITIES	**NUMBER**	**UNIT**	**HOUR**	**TOTAL (WORKLOAD)**
Course Teaching Hour (14 weeks* total course hours)	14	Week	3	42
Preliminary Preparation and finalizing of course notes, further self- study	14	Week	3	42
Assignment (s)	3	Number	8	24
Presentation/ Seminars		Number		

Quiz and Preparation for the Quiz		Number		
Mid- Term(s)	1	Number	20	20
Project (s)		Number		
Field Studies (Technical Visits, Investigate Visit etc.)		Number		
Practice (Laboratory, Virtual Court, Studio Studies etc.)		Number		
Final Examination/ Final Project/ Dissertation and Preparation	1	Number	30	30
Other (Placement/Internship etc.)		Number		
Total Workload				158
Total Workload/ 25				6.30
ECTS				**6**

ETHICAL RULES WITH REGARD TO THE COURSE (IF AVAILABLE)	
You are expected to act ethically and comply with all academic standards in this course. Any form of cheating and plagiarism will not be allowed.	
STUDENT WITH DISABILITIES OR SPECIAL NEEDS	
Students with disabilities or special needs are encouraged to contact the instructor and the Unit for Student with Disabilities (http://eob.yasar.edu.tr/) for academic adaptations.	
ASSESSMENT and EVALUATION METHODS:	
Final Grades will be determined according to the Yaşar University Associate Degree, Bachelor Degree and Graduate Degree Education and Examination Regulation.	
PREPARED BY	Dr. Dindar ÖZ
UPDATED	01.04.2022
APPROVED	