MATHEMATICAL FOUNDATIONS OF COMPUTING

1	Course Title:	MATHEMATICAL FOUNDATIONS OF COMPUTING	
2	Course Code:	BM6021	
3	Type of Course:	Optional	
4	Level of Course:	Third Cycle	
5	Year of Study:	1	
6	Semester:	1	
7	ECTS Credits Allocated:	6.00	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:	None	
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Dr. Ögr. Üyesi CEYDA NUR ÖZTÜRK	
15	Course Lecturers:	Prof. Dr. Kemal FİDANBOYLU	
16	Contact information of the Course Coordinator:	ceydanur@uludag.edu.tr	
17	Website:		
18	Objective of the Course:	To teach the mathematical approaches that form the basis and are useful in design, learning, or evaluation processes of artificial intelligence methods, and in this context to carry out thorough examinations of signal analysis, probability theorem, optimization techniques, decision processes, statistical tests, information theory, fuzzy logic, belief theory, decision processes, and deep networks.	
19	Contribution of the Course to Professional Development:	To have students comprehend the operational logic behind commonly used artificial intelligence methods and build the necessary mathematical foundations to design similar intelligent methods.	
20	Learning Outcomes:		
		1	Knowing the requisites and deficiencies of the artificial intelligence systems
		2	Being able to analyze real problems so as to solve them with artificial intelligence systems
		3	Being able to associate probability, information, and belief theories with representation, learning, or testing phases of the intelligent systems
		4	Being knowledgeable about optimization techniques that enable learning
		5	Being able to describe the differences between the fuzzy logic-based and probability-based applications
		6	Being able to learn empirical or statistical models with decision trees, artificial neural networks, or deep networks
		7	Being able to ground the evolution of learning strategies from artificial neural networks to deep networks
		8	
		9	
		10	
21	Course Content:		
	Course Content:		

Week	Theoretical	Practice
1	Limits of artificial intelligence, human-level artificial intelligence, expert systems	
2	Signal terminology and signal characteristics	
3	Probability theory, conditional probability, Bayes' theorem, independence	
4	Probability-based classifiers, data preparation, evaluation	
5	Basics of learning and optimization techniques	
6	Optimization in artificial neural networks, backpropagation, network parameters	
7	Random processes and decision making	
8	Statistical tests, information theory	
9	Fuzziness and belief theory	
10	Applications of fuzzy logic	
11	Hopfield networks, Boltzmann machines	
12	Deep restricted Boltzmann machines	
13	Variational autoencoders	
14	Reinforcement learning, Markov decision processes	

22	Textbooks, References and/or Other Materials:	1. Jackson, P. C., 2019. Toward Human-Level Artificial Intelligence. Dover Publications Inc. ISBN-10: 0486832082 ISBN-13: 978-0486832081. 2. Russell, S. J., Norvig, P., 2010. Artificial Intelligence: A Modern Approach. Prentice Hall. ISBN-10: 0136042597 ISBN-13: 978-0136042594. 3. Stone, J. V., 2019. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning. Sebtel Press, ISBN-10: 0956372813 ISBN-13: 978-0956372819.
23	Assesment	

Activites		Number	Duration (hour)	Total Work Load (hour)
Theoretical		14	3.00	42.00
Practicals/Labs		0	0.00	0.00
Self study and preperation		14	3.00	42.00
Homeworks		3	18.00	54.00
Projects		0	0.00	0.00
Field Studies		0	0.00	0.00
Midterm Exam	1	1	16.00	16.00
Others		0	0.00	0.00
Final Exams		1	24.00	24.00
Home work-project	3	30.00		
Total Work Load				178.00
Total	5	100.00		
Total work load/ 30 hr				5.93
ECTS Credit of the Course				6.00

Success Grade	
Contribution of Final Exam to Success Grade	50.00
Total	100.00
Measurement and Evaluation Techniques Used in the Course	written exams, assignments, research report, presentation

24	**ECTS / WORK LOAD TABLE**

25	**CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS**															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

ÖK2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK3	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK4	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK5	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK6	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK7	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0

LO: Learning Objectives PQ: Program Qualifications

Contribution Level:	**1 very low**	**2 low**	**3 Medium**	**4 High**	**5 Very High**