DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

Course Details				
Code	**Academic Year**			**Semester**
RIS501	1			1
Title	**T**	**A**	**L**	**ECTS**
Engineering Mathematics	2	2	0	8

Language	English					
Level	**Undergraduate**		**Graduate**	x	**Postgraduate**	
Department / Program	Robotics and Intelligent Systems					
Forms of Teaching and Learning						
Course Type	**Compulsory**		**Elective**	x		
Objectives	To learn the mathematics underlying machine learning					
Content	Linear algebra (summary), analytic geometry (summary), matrix decompositions, calculus of vectors and matrices, probability and distributions, continuous optimisation, central machine learning problems, linear regression, dimensionality reduction and PCA, density estimation and Gaussian mixture models					
Prerequisites						
Coordinator						
Lecturer(s)	Assoc. Prof. Dr. Emre IŞIK					
Assistant(s)	Instructor Sebahattin BABUR					
Work Placement						

Recommended or Required Reading	
Books / Lecture Notes	
Other Sources	Mathematics for Machine Learning; M.P. Deisenroth, A.A. Faisal, C.S. Ong, Cambridge University Press, 2020 (açık erişim: http://mml-book.com)

Additional Course Material	
Documents	
Assignments	End-of-chapter exercises
Exams	

Course Composition		
Mathematics und Basic Sciences		%70
Engineering		%15
Engineering Design		%
Social Sciences		%

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Educational Sciences		%
Natural Sciences		%15
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	100
Quiz		
Assignments		
Attendance		
Recitations		
Projects		
Final Exam	1	100
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	2	28
Self-Study	14	10	140
Assignments	5	5	25
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	14	2	28
Laboratory			
Projects			
Final Exam	1	2	2
		Total Work Load	**225**
		ECTS Points (Total Work Load / Hour)	**8**

Learning Outcomes

1	Understanding analytical geometry in linear-algebraic notation
2	Acquaintance with matrix decomposition methods
3	Ability to calculate gradients of many-valued functions in many-dimensional parameter spaces
4	Ability to synthesise data obeying given probability distributions
5	Comprehension of basic optimisation techniques
6	Ability to construct probabilistic models and parameter inferences
7	Understanding the mathematical background of basic techniques used in machine learning problems

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10	
11	
12	
Weekly Content	
1	Linear algebra I
2	Linear algebra II
3	Analytical geometry I
4	Analytical geometry II
5	Matrix decompositions
6	Calculus of vectors and matrices
7	Probability and distributions I
8	Probability and distributions II
9	Continuous optimisation
10	Modelling data I
11	Modelling data II
12	Linear regression
13	Dimensionality reduction and principal component analysis (PCA)
14	Density estimation and Gaussian mixture models
15	

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High						

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Compiled by:	
Date of Compilation:	