



**ESOGU ELECTRICAL-ELECTRONICS ENGINEERING DEPARTMENT**  
**COURSE INFORMATION FORM**

Course Title		Course Code
Machine Learning		151228622

Semester in Program	Number of Course Hours per Week		ECTS Credit
	Theory	Practice	
8	3	0	5

Course ECTS Credit Distribution				
Basic Sciences	Engineering Sciences	Design	General Education	Social
1	4			

Language of Instruction	Course Level	Course Type
English	Undergraduate	Elective

<b>Prerequisite</b>	Probability, Linear Algebra
<b>Objectives of the Course</b>	Give students an understanding of the fundamental concepts and underlying mathematical relationships in machine learning. Introduce students to various machine learning techniques.
<b>Brief Course Content</b>	Decision Trees, Ensemble Learning, Linear Regression and Classification Models, Neural Networks, Kernel Methods, Sequence Models, Deep Generative Models, Reinforcement Learning

Learning Outcomes of the Course		Contributed POs	Teaching Methods *	Assessment Methods **
<b>1</b>	An understanding of the fundamental concepts in machine learning	1b, 1c	1, 10, 11	A, B, D
<b>2</b>	An understanding of underlying mathematical relationships within machine learning algorithms	1a, 1c	1, 10, 11	A, B, D
<b>3</b>	An understanding of a wide variety of machine learning algorithms	1c	1, 10, 11	A, B, D
<b>4</b>	Ability to compare different machine learning approaches	1c, 1d, 2	1, 10, 11	A, B, D
<b>5</b>	Ability to implement various machine learning algorithms	1d, 2, 3	3, 10, 11	D
<b>6</b>				
<b>7</b>				
<b>8</b>				

\*Teaching Methods **1**:Lecture, **2**:Discussion, **3**:Experiment, **4**:Simulation, **5**:Question-Answer, **6**:Tutorial, **7**:Observation, **8**:Case Study, **9**:Technical Visit, **10**:Problem Solving, **11**:Individual Work, **12**:Team/Group Work, **13**:Brain Storm, **14**:Project Design / Management, **15**:Report Preparation and/or Presentation

\*\*Assessment Methods **A**:Exam, **B**:Quiz, **C**:Oral Exam, **D**:Homework, **E**:Report, **F**:Article Examination, **G**:Presentation, **I**:Experimental Skill, **J**:Project Observation, **K**:Class Attendance; **L**:Jury Exam

<b>Main Textbook</b>	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
<b>Supplementary Resources</b>	Ethem Alpaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010. Christopher M. Bishop, Hugh Bishop, Deep Learning: Foundations and Concepts, Springer, 2024.
<b>Necessary Course Material</b>	

Course Weekly Schedule	
<b>1</b>	Introduction - Basic Concepts of Machine Learning

<b>2</b>	Nearest Neighbor Classifier, Decision Tree Learning and Ensemble Learning
<b>3</b>	Linear Models for Regression, Least Squares
<b>4</b>	Linear Models for Regression, Bayesian Linear Regression
<b>5</b>	Linear Models for Classification, Discriminant Functions
<b>6</b>	Linear Models for Classification, Probabilistic Generative Models, Probabilistic Discriminative Models
<b>7</b>	Bayesian Logistic Regression
<b>8</b>	Mid-Term Exams
<b>9</b>	Neural Networks, Feed-forward Network Functions
<b>10</b>	Neural Networks, Network Training, Error Backpropagation
<b>11</b>	Neural Networks, Regularization in Neural Networks
<b>12</b>	Kernel Methods
<b>13</b>	Sequence Models, RNNs, Transformers
<b>14</b>	Deep Generative Models, Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs)
<b>15</b>	Reinforcement Learning
<b>16,17</b>	Final Exams

Calculation of Course Workload			
Activities	Count	Time (Hour)	Total Workload (Hour)
Weekly classroom time	14	3	42
Weekly study time (review, reinforcing, preparation)	14	3	42
Homework	6	4	24
Taking a quiz	4	1	4
Studying for a quiz	4	4	16
Oral exam			
Studying for an oral exam			
Report writing (Preparation and presentation time included)			
Project (Preparation and presentation time included)			
Presentation (Preparation time included)			
Mid-Term Exam	1	1	1
Studying for Mid-Term Exam	1	10	10
Final Exam	1	1	1
Studying for Final Exam	1	10	10
			<b>Total workload</b>
			<b>150</b>
			<b>Total workload / 30</b>
			<b>5</b>
			<b>Course ECTS Credit</b>
			<b>5</b>

Assessment	
Activity Type	%
Mid-term	30
Quiz	30
Homework	10
<b>Final Exam</b>	<b>30</b>
<b>Total</b>	<b>100</b>

**COURSE CONTRIBUTION TO THE PROGRAM OUTCOMES**

(5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low)

NO	PROGRAM OUTCOMES	Contribution
1	a. Sufficient knowledge of mathematics	4
	b. Sufficient knowledge of basic sciences	3
	c. Sufficient basic engineering and Electrical-Electronics engineering knowledge	5
	d. Skill of applying all these knowledge and experience to complicated Electrical-Electronics engineering problems	4
2	Skill of defining, identifying, formulating and solving the complicated problems in Electrical-Electronics engineering and related areas by applying appropriate analysis and modelling methods.	3
3	Skill of designing a complicated process, system, equipment or product by applying modern design methods under realistic constraints and conditions.	3
4	To analyze and solve the complicated engineering problems:	
	a. skill of developing, selecting and applying the required techniques and devices	
5	b. skill of using information technologies effectively	
	To study the complicated on the complicated Electrical-Electronics engineering problems and research subjects:	
	a. skill of experimental design	
6	b. skill of performing the experiments, collecting the data and analyzing and interpreting the results	
	a. Skill of performing individual studies	
7	b. Skill of performing intra and interdisciplinary and multidisciplinary teamwork and studies	
	a. Skill of effective oral and written communication in Turkish and English	
	b. Skill of improving and using foreign language knowledge	
	c. Skill of effective reporting, understanding the reports and preparing the design and production reports	
8	d. Skill of effective presentation and giving and getting clear and understandable instructions.	
	Awareness of the necessity of life-long learning and skill of accessing to information and following the improvements in contemporary science and technology	
9	a. Awareness of necessity of behaving in accordance with the ethical principles and awareness of the importance of having professional ethical responsibilities	
	b. Knowledge about legal regulations and standards of engineering	
10	a. Knowledge about project management, risk management and change management	
	b. Awareness of the significance of entrepreneurship and innovation	
	c. Knowledge about sustainable development	
11	Knowledge about the effects of engineering applications and practices on the global and social health, ecology and safety, knowledge about the current problems in relation to the working areas of Electrical-Electronics engineering; and awareness of the legal issues resulting from engineering solutions	
12	Knowledge about modern problems in local and universal scale	

**INSTRUCTORS**

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**Date:**01.10.2024