

COURSE INFORMATION					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
STATISTICAL INFERENCE	ESYE647		3+0	3	10

Prerequisites	A background in statistics at the level of ISE254.
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Language of Instruction	English
Course Level	Ph.D.
Course Type	Elective
Course Coordinator	
Instructors	Prof. Dr. Ali Taylan Ula
Assistants	
Goals	To introduce the basic principles and methods of statistical inference.
Content	Maximum-likelihood estimation. Unbiasedness, consistency, sufficiency, completeness and uniqueness. Minimum-variance unbiased estimators. Fisher information and Rao-Cramer lower bound. Efficiency. Exponential class. Bayesian estimation. Best tests. Uniformly most powerful tests. Likelihood-ratio tests.

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
Ability to find the distributions of functions of random variables.	5	1	A,C
Ability to find limiting distribution.	5	1	A,C
Ability to estimate parameter(s) for any distribution by maximum-likelihood method.	5	1	A,C
Ability to apply advanced statistical topics as consistency, sufficiency, completeness, uniqueness and exponential class.	5	1	A,C
Ability to apply advanced topics as Fisher information, Rao-Cramer lower bound and efficiency.	5	1	A,C
Ability to find minimum-variance unbiased estimator.	5	1	A,C
Ability to find Bayes estimators.	5	1	A,C
Ability to apply advanced topics as best tests, uniformly most powerful tests and likelihood ratio tests.	5	1	A,C

Awareness of ethical values.	10		A,C
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Teaching Methods:	1: Lecture, 2: Paper Discussion, 3: Lab, 4: Case-Study
Assessment Methods:	A: Testing, B:Paper Summary, C: Homework, D: Project

COURSE CONTENT		
Week	Topics	Study Materials
1	Introduction. Maximum-Likelihood Estimation.	Textbook
2	Unbiasedness. Consistency. Sufficiency.	Textbook
3	Completeness. Uniqueness.	Textbook
4	Minimum-Variance Unbiased Estimators.	Textbook
5	Fisher Information.	Textbook
6	Rao-Cramer Lower Bound. Efficiency.	Textbook
7	MIDTERM EXAM I Exponential Class.	Textbook
8	Exponential Class.	Textbook
9	Bayesian Estimation.	Textbook
10	Bayesian Estimation.	Textbook
11	Best Tests.	Textbook
12	MIDTERM EXAM II Uniformly Most Powerful Tests.	Textbook
13	Likelihood Ratio Tests.	Textbook
14	Likelihood Ratio Tests.	Textbook

RECOMMENDED SOURCES	
Textbook	Introduction to Probability and Mathematical Statistics, 2nd Ed. L. J. Bain and M. Engelhardt Duxbury Press, 2000.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	8 Homeworks.
Exams	2 Midterm Exams, Final Exam, 2 Quizzes.

ASSESSMENT		
	IN-TERM STUDIES	PERCENTAGE
Mid-terms	2	76
Assignments	8	8
Quizzes	2	8
Attendance		8
	Total	100
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
	Total	100

COURSE CATEGORY	Expertise Courses
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COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Ability to reach knowledge in breadth and depth through scientific research in Systems Engineering field; to have extensive knowledge about current techniques and procedures together with their constraints.					
2	Ability to complement and apply knowledge by scientific methods utilizing limited or missing data; to use knowledge in different disciplines effectively by blending them.					
3	Ability to formulate Systems Engineering problems; to develop novel and original ideas and procedures for their solutions and to use innovative procedures in solutions.					
4	Awareness of new and developing applications in Systems Engineering; ability to investigate and learn these applications when required.					
5	Ability to design and apply analytical, and modeling and experimental based research; to solve and interpret complex situations encountered in this process.					X
6	Ability to lead multi-disciplinary teams; to develop solution approaches in complicated situations and to take responsibility.					
7	Ability to develop novel and/or original ideas and methods; to develop innovative solutions for the design of systems, parts or the processes.					
8	Ability to communicate orally or in writing the process and the results of Systems Engineering studies systematically and openly in national or international platforms.					
9	Ability to master a foreign language (English) at the European Language Portfolio B2 General Level to communicate orally or in writing.					
10	Ability to recognize social, scientific and ethical values in the process of collection, interpretation and publishing of data, and in all professional activities.					X
11	Ability to visualize social and environmental dimensions of Systems Engineering applications and to observe these dimensions in professional practice.					
12	Ability to develop appropriate methodology and procedures for the modeling, improvement, control and design of complex systems for a specified target.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Midterm examination	2	2	4
Homework	8	10	80
Project			
Final examination	1	2	2
Total Work Load			260
Total Work Load / 25 (h)			10,4
ECTS Credit of the Course			10