COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ENGINEERING EXPERIMENTAL DESIGN	**ESYE541**		**3 + 0**	**3**	**10**

Prerequisites	A background in statistics at the level of ISE254.

Language of Instruction	English
Course Level	M. Sc.
Course Type	Elective
Course Coordinator	
Instructors	Prof. Dr. Ali Taylan Ula
Assistants	
Goals	To introduce the basic principles and methods of statistical design of experiments. The significances of effects of various factors on a given response are determined under uncertainty using statistical principles.
Content	Two-sample tests, one-way analysis of variance, randomized block designs, factorial designs, two-way anova, 2k factorial designs, random effects, mixed effects, simultaneous confidence intervals, EMS, power computations, statistical package applications.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
Ability to collect data, analyze data, interpret and present the results.	2	1,3	A,C
Ability to design an experiment.	5	1,3	A,C
Ability to analyze and interpret the experiment results by analysis of variance (anova).	5	1,3	A,C
Ability to interpret the experiment results by simultaneous confidence intervals.	5	1,3	A,C
Ability to do power computations for tests. Ability to find the required sample size for a given power.	5	1,3	A,C
Ability to consider random effects and mixed effects.	5	1,3	A,C
Ability to use statistical package MINITAB.	5	3	A,C
Being aware of ethical responsibility.	10		A,C

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 to Design of Experiments. A Review of Basic Statistical Concepts.	Textbook
2	Comparing Several Means. Analysis of Variance (Anova).	Textbook
3	Single-Factor Experiments. One-Way Anova. Tests.	Textbook
4	One-Way Anova. Simultaneous Confidence Intervals. Estimates of Parameters.	Textbook
5	Expected Mean Square (EMS). Power Computations.	Textbook
6	Special Case of Two Means.	Textbook
7	MIDTERM EXAM I Random Effects Model.	Textbook
8	Randomized Block Designs. Tests.	Textbook
9	Randomized Block Designs. Simultaneous Confidence Intervals.	Textbook
10	Factorial Designs.	Textbook
11	Two-Factor Experiments. Two-way Anova. Tests. Confidence Intervals.	Textbook
12	MIDTERM EXAM II Two-Factor Experiments. Interaction.	Textbook
13	Mixed Effects Models.	Textbook
14	2^k Factorial Designs. MINITAB Applications.	Textbook

RECOMMENDED SOURCES	
Textbook	Design and Analysis of Experiments, 7th Ed. D. C. Montgomery, John Wiley & Sons, 2009.
Additional Resources	Probability and Statistics for Engineers and Scientists, 9th Ed. R. E. Walpole, R. H. Myers, S. L. Myers and K. Ye , Pearson Education, 2012.

MATERIAL SHARING	
Documents	
Assignments	5 Homeworks with problems from the textbook.
Exams	2 Midterm Exams, Final Exam, 2 Quizzes.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	76
Assignments	5	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

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.					X	
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)	16	8	128
Midterm examination	2	2	4
Homework	8	10	25
Final examination	1	2	2
Total Work Load			250
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10