Course number and name	END 446E / Statistical Experimental Design
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Erkan IŞIKLI
Text book and other supplemental materials	• Montgomery, D.C. (2009). *Design and Analysis of Experiments*, 7th ed., John Wiley & Sons, Inc. • Montgomery, D.C. & Runger, G.C. (2011). *Applied Statistics and Probability for Engineers*, 5th ed., John Wiley & Sons, Inc. • Minitab Statistical Software.

Course information	
Content	Basic concepts of statistics: sampling distributions, testing hypotheses and goodness of fit. Correlation and regression: linear, nonlinear, and multiple linear correlation and regression analysis. Analysis of variance: estimating variance components in experimental measurements, multiple factor analysis of variance, factorial experimental design, completely randomized designs, blocking designs, full factorial designs with two levels, fractional designs with two levels and response surface designs. Designing experiments to estimate parameters in nonlinear models. Effects of measurement errors on calculated values.
Prerequisites	END 252E Theory of Probability, END 311E Statistics
Type	Selected elective

Course learning outcomes
Students who pass the course will: I. have learned the basic principles of experimental design and how to apply them to engineering problems. II. be able to identify different types of experimental design and conduct appropriate designs for an engineering problem. III. be able to estimate appropriate models using statistical software for available data. IV. be able to interpret the experimental results and draw conclusions.

Student outcomes	Level of contribution
SO1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	Partial
SO2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	Little
SO3. An ability to communicate effectively with a range of audiences.	Not applicable
SO4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Not applicable
SO5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	Little
SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Partial

Week	Topics	Learning outcome(s)
1	Fundamentals, Key Concepts, Advantages/Disadvantages of Experimental Design	I
2	Measures of Central Tendency and Dispersion, Statistical Graphs, Hypothesis Testing, Power and Sample Size Determination	I
3	Simple Designs and Single-Factor Experiments	I, III, IV
4	Fixed and Random Effects Models	II, IV
5	Full Factorial Designs	II, IV
6	2-Level Factorial (2^k) Designs	II, IV
7	Nuisance Factors, Complete Randomized Block Designs, Confounding	II, IV
8	2-Level Fractional Factorial (2^{k-p}) Designs	II, IV
9	Latin Squares and Related Designs	II, IV
10	3-Level and Mixed-Level Factorial Designs	II, IV
11	Regression Models	II, IV
12	Model Diagnostics, Goodness-of-Fit	II, IV
13	Response Surface Methodology	II, IV
14	Taguchi Method	I, II, IV