THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Design and Analysis of Experiments

CBE 5779

Credit Hours:
3.00 - 3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Design and analysis of experiments with emphasis on applications in engineering.

Prerequisites and Co-requisites:
Prereq: Jr or Sr standing in CBE.

Course Goals / Objectives:

- Familiarize w/ statistical concepts and terminology in chemical systems and processes: data types & distributions, Central Limit Theorem, sampling, replication & randomization, constructing & testing statistical hypotheses, type I & type II errors
- Become familiar with proper ways to report results using critical values, p-values, confidence intervals, and graphical techniques
- Master the application and interpretation of the analysis of variance (ANOVA) of data from relatively simple experiments
- Master fundamental principles of linear regression models, including models for both continuous and categorical (discrete) factors
- Master basic methods of measuring the adequacy of a model, including: analysis of residuals, variance tests, R2 and adjusted R2 statistics, lack-of-fit test
- Become familiar with retrospective power analysis and its relation to sample size
- Master the basic principles of factorial designs with emphasis on 2k factorial designs, the use of blocking to handle nuisance variables, and fractional factorial designs
- Become familiar with the response surface methodology for optimization experiments
- Be exposed to advanced experimental designs strategies, including ?optimal? designs, split-plot designs, mixture designs, and method of augmenting existing designs

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Course Topics:

- Data types and different ways to classify variables; basic statistical concepts and terminology: sampling and sampling distributions; histograms
- Different types of probability distributions; standardization and normalization; the Central Limit Theorem; extreme values in a distribution
- Constructing and testing a statistical hypothesis: the null and alternative hypotheses, type I and type II errors; p-value; one-and two-sample means tests
- Confidence intervals; matched pairs designs; checking the normality assumption; hypothesis tests about variances
- Analysis of data from experiments with a single factor; means and effects models; ANOVA; comparing multiple pairs of means and the least significant difference (LSD)
- Outliers; measures of model adequacy (residuals analysis, R2 and adjusted-R2, variance tests)
- Retrospective and prospective power analysis; linear regression models, parameter estimation, hypothesis tests for model parameters; checking model adequacy
- Blocking design strategies; factorial design; two-way ANOVA; factor coding; response curves and surfaces; models containing both continuous and discrete factors
- Blocking in a factorial design; screening experiments: the 2k factorial design; replication and center points
- Blocking and confounding in the 2k factorial design,complete and incomplete blocking strategies; two-level fractional factorial designs; augmenting a design
- Response surface methodology (RSM) for process/product optimization; "optimal" designs, mixture (chemical composition) designs

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Designation:

Elective