

Course Syllabus
Engineering Experimental Design
First Semester 1433/1434H

Course **IE520 – Engineering Experimental Design**

Instructor Ali Ahmad, Ph.D.
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Class Meeting Time: Sunday 1:00 -3:30 PM (subject to change)

Office Hours: By appointment

Textbook Montgomery, *Design and Analysis of Experiments*, 7th Edition.

Additional resources:

1. Roy, Ranjit K, *Design of Experiments Using the Taguchi Approach: 16 Steps to Product and Process Improvement*, John Wiley & Sons, Inc. 2001.
2. G. Casella, S. Fienberg, and I. Olkin, *Statistical Analysis of Designed Experiments*, Third Edition, Springer Science Business Media, LLC, 2009.
3. Klaus Hinkelmann and Oscar Kempthorne, *Design and Analysis of Experiments (Volume 2: Advanced Experimental Design)*, A JOHN WILEY & SONS, INC, 2005.
4. J. Antony, *Design of Experiments for Engineers and Scientists*, Elsevier Science & Technology Books, 2003.
5. G. E. P. Box and N. R. Draper, *Response Surfaces, Mixtures, and Ridge Analyses*, John Wiley & Sons, Inc, 2007.
6. Additional resources are provided.

Optional Software **Minitab 16, Statistica 9, other experimental design and analysis software**

Description A study of the design and analysis of experiments. A model-based approach examines both theoretical and practical issues associated with experimentation. Topics include ANOVA, blocked designs, partially balanced incomplete designs, factorial designs, fractional factorial designs, nested designs, response surface methods and others.

Objectives Students be able to design and conduct appropriate experiments, as well as analyze and interpret appropriate experimental data. Finally, the student will be able to analyze the results of the experiments.

Research Paper Presentation Each student needs to select and prepare a presentation on a paper that deals with application of experimental design methodology.

Term Project A group of 3-4 students needs to apply the experimental design methodology on a real world project.

Grades	Reading Assignments/ Topic Discussions	15%
	Homework and Case Studies	15%
	Research paper presentation	10%
	Experimental Design and Analysis project	20%
	Final Exam	40%

IE 520: Engineering Experimental Design
Course Outline (Subject to Change)

Session	Week of	TOPIC (s)	Readings / Assignments
1	08-Sep-12	Introduction to Designed Experiments Importance and Need for Experimental Design	Chapter 1 Paper 1: The new mantra: MVT Homework: 1.4
2	15-Sep-12	Statistics Review Introduction to Statistical Analysis Software	Chapter 2, Chapter 3 Homework: 2.3, 2.20, 2.29, 3.11, 3.22, 3.40
3	22-Sep-12	Experiments with Blocking Factors	Chapter 4 (except section 4.3) Homework: 4.5, 4.11, 4.12, 4.20 Project Abstract/Group Information is Due
4	29-Sep-12	Factorial Experiments	Chapter 5 Paper 2: How to Design Smart Business Experiments Homework: 5.9, 5.12, 5.22, 5.30
5	06-Oct-12	Two-Level Factorial Designs	Chapter 6 Homework: 6.2, 6.11, 6.18, 6.28
6	13-Oct-12	Two-Level Factorial Design (Cont'd) Blocking and Confounding Systems for Two-Level Factorials	Chapter 7 Paper 3: Achieving Breakthroughs in Non-Manufacturing Processes via Design of Experiments (DOE) Homework: 7.3, 7.8, 7.17 Each student should submit their selected research paper via e-mail
7	20-Oct-12	No Class	
8	27-Oct-12	No Class	
9	03-Nov-12	Two-Level Factorial Designs	Chapter 8 Homework: 8.5, 8.7, 8.21, 8.22, 8.27
10	10-Nov-12	Other Topics on Factorial and Fractional Factorial Designs	Chapter 9 Homework: 9.6, 9.9, 9.22
11	17-Nov-12	Regression Modeling	Chapter 10 Paper 4: Each student should research a paper that discusses an application of regression modeling Homework: 10.2, 10.6, 10.9
12	24-Nov-12	Response Surface Methodology	Chapter 11 (except 11.6)
13	01-Dec-12	Response Surface Methodology (Cont'd)	Chapter 11 (except 11.6) Homework: 11.4, 11.9, 11.12, 11.13
14	08-Dec-12	Robust Design	Chapter 12 Homework: 12.5, 12.9, 12.11
15	15-Dec-12	Individual Research Paper Presentations	Paper Presentations are Due for all students
16	22-Dec-12	Group Project Presentations	Term Project is Due for all groups

Important Notes:

- 1) All reading assignments are due before class, i.e., Chapter 1 and paper 1 should be read before class meeting in the week of September 8, 2012.
- 2) Homework is due the following class.
- 3) Paper and project assignments are due in class the week that they are mentioned.
- 4) Final Exam will be scheduled per university guidelines.