

STAT 423 – Design and Analysis of Experiments II

Winter 2016

1. Catalog Description

STAT 423 Design and Analysis of Experiments II (4)

Continuation of Stat 323. 2^k factorial designs, 3^k factorial designs, balanced and partially balanced incomplete block designs, nested designs, split-plot designs, response surface methodology, confounding, repeated measures, and other design approaches. 4 lectures. Prerequisite: Stat 323.

2. Required Background and/or Experience

Introductory work in statistics and design of experiments.

3. Expected Outcomes

The student should be able to:

- a. understand the underlying principles of experimental design;
- b. understand the rationale behind the use of 2^k , 3^k , balanced and partially balanced incomplete block designs, split-plot, repeated measures, and response surface designs;
- c. be able to recognize different designs;
- d. be able to choose appropriate designs for experiments in her or his area of special interest and in other areas;
- e. be able to analyze the data obtained from experiments conducted using the methods presented in this course and express the results of the quantitative work using their writing skills.

4. Text and References

Text: Montgomery, Douglas C., *Design and Analysis of Experiments*, 7th ed., Wiley, 2009.

References: Box, George, Hunter, William and Hunter, J.S., *Statistics for Experimenters*, Wiley, 2nd ed., 2005.

Hinkelmann, K. and Kempthorne, O., *Design and Analysis of Experiments, Volume 2: Advanced Experimental Design*, Wiley, 2005.

Kuehl, Robert O., *Statistical Principles of Research Design and Analysis*, 2nd ed., Duxbury, 2000.

Myers, R.H., and Montgomery, D.C., *Response Surface Methodology*, 2nd ed., Wiley, 2002.

Oehlert, Gary W., *A First Course in Design and Analysis of Experiments*, W.H. Freeman, 2000.

5. Minimum Student Materials

None.

6. **Minimum University Facilities**

Chalkboards (whiteboards) for classroom use. Computer with access to statistical software for student use in preparing assignments. Smart room is preferred.

7. **Expanded Description of Content and Method**

<u>CONTENT</u>	<u>NUMBER OF LECTURES</u>
A. 2^K FACTORIAL DESIGN	6
1. addition of center points	
2. blocking and confounding	
3. aliases	
4. fractional designs	
5. analysis by computer	
B. 3^K FACTORIAL DESIGNS	6
1. confounding and aliases	
2. fractional designs	
3. analysis by computer	
C. BALANCED INCOMPLETE BLOCK DESIGNS	3
D. PARTIALLY BALANCED INCOMPLETE BLOCK DESIGNS	2
E. MULTIFACTOR EXPERIMENTS WITH RANDOMIZATIONS	
RESTRICTIONS	5
1. nested designs	
2. split-plot designs	
3. analysis by computer	
F. RESPONSE SURFACE METHODOLOGY	6
1. 2 ^k factorial and fractional factorial designs	
1. Central Composite Design	
2. Box-Behnken Design	
3. Cuboidal vs. Spherical Designs	
4. analysis of second order models	
G. REPEATED MEASURES DESIGNS	5
Studies of time trends	
1. Relationships among repeated measurements	
2. Univariate Analysis of Variance for repeated measures	
3. Other experiments with repeated measures properties	
4. Degrees of freedom adjustments for repeated measures	
H. OTHER DESIGN APPROACHES	4
1. Taguchi's approach and others	——
2. Analysis of Covariance	
Total	37

METHOD

Lecture supported by computer lab. Material from references and additional problems supplement the text.

8. **Method of Evaluating Outcome**

Homework, computer assignments, projects, and exams.