

STAT 4530
Design of Experiments I
Fall 2011

Calendar Entry:

STAT 4530 - Design of Experiments 1 (3). (Formerly 005.453) Objectives in designing experiments; designs commonly used in research including analysis and an introduction to the construction of designs. *Prerequisite: STAT 3800 (C) or the former STAT 3600 (C); and STAT 3480 (C); or consent of department.*

Instructor:

J. F. Brewster; 340 Machray Hall; 474-8172; john_brewster@umanitoba.ca

Office Hours¹:

Mondays	8:30 am–9:20 am
Thursdays	11:30 am–12:20 pm

Mark Breakdown:

Test #1 (tentatively, October 13)	20%
Test #2 (tentatively, November 17)	20%
Final Examination	40%
Project	10%
Assignments	5%
In-class Activities	5%

Text and Software:

Montgomery, Douglas C. (2008), *Design and Analysis of Experiments*, 7th ed., Wiley, New York (bundled with *Design Expert* software). Supplementary material is available through www.wiley.com/college/montgomery.

On Collaboration and Academic Dishonesty:

I have been asked to draw your attention to the sections in the *University of Manitoba Calendar* dealing with academic dishonesty. More information is available at:
www.umanitoba.ca/science/undergrad/resources/webdisciplinedocuments.html.

¹These are times at which I intend to be in my office on a regular basis. If these times do not work for you, then please feel free to make an appointment with me or drop by my office (on a chance basis).

Course Content:

1. Basic Principles of Design [Chapter 1; review]
2. 2^k Factorial Designs [Chapter 6]
3. Blocking and Confounding in 2^k Designs [Chapter 7]
4. 2^{k-p} Fractional Factorial Designs [Chapter 8]
 - 2^{k-1} , 2^{k-2} and 2^{k-3} Designs
 - Generators, Defining Relation, Alias Structure, Resolution
 - Aberration, Clear Effects, Fold-Over Designs
 - Blocking 2^{k-p} Designs, Blocking Generators and Factor Generators
5. Split-Plot Designs [Section 14.4+]
 - Hard-to-Vary and Easy-to-Vary Factors
 - The Consequences of a Split-Plot Structure
 - Fractional Factorial Split-Plot Designs
 - Blocking Fractional Factorial Split-Plot Designs
6. Response Surface Methodology [Chapter 11]
 - Goals of Response Surface Methodology, Method of Steepest Ascent
 - Analysis of Second-Order Response Surfaces
 - Experimental Designs for Fitting Response Surfaces
 - Multiple Responses, Constrained Optimization, Desirability Functions
7. Robust Parameter Design [Chapter 12+]
 - Goals of Robust Parameter Design, Control Factors and Noise Factors
 - Taguchi's Philosophy
 - Split-Plot Experiments for Robust Parameter Design
8. Miscellaneous Topics and Issues²
 - Fixed and Random Effects, Mixed Models
 - Nested and Crossed Factors; Roles of Expected Mean Squares
 - Balanced Incomplete Block Designs
 - Additive and Multiplicative Models, Transformations
 - 3-Level Fractional Factorial (3^{k-p}) Designs; Designs with Mixed Levels
 - Regression Diagnostics
 - Mixture Experiments
 - Computer Experiments, Space-Filling Designs
 - Measurement Issues, Gauge Capability Studies
 - Statistical Communication, Writing Reports and Giving Presentations
 - Using Computer Software for Designing and Analyzing Experiments

²These topics will be introduced and discussed at various times throughout the course, as appropriate. Some of these topics will be “review” for you. In many cases, the discussion will be brief—my intention being simply to introduce (or review) the topic and to give some references. In some cases you may be asked to read material on your own.