STAT 4590
Design of Experiments 2
Winter Term 2011

Instructor: Dr. Saumen Mandal

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Class Time: Tuesdays, Thursdays: 10:00 a.m. – 11:15 a.m. (316 Machray Hall)

Office Hours: Tuesdays, Thursdays: 12:30 p.m. – 2:00 p.m.
and by appointment or whenever I am in.

Text: Design and Analysis of Experiments by Douglas C. Montgomery.
7th Edition, ISBN: 978-0-470-12866-4, John Wiley & Sons. This is the same textbook as you used in STAT 4530 Fall 2010 course.

Some notes will be provided.

Assignments, Presentation and Tests: There will be two assignments, one presentation, and two term tests. Each student will be given a topic (project) and will be asked to give a presentation for about 15-20 minutes. The dates of the term tests will be given later. You can check the information/announcements in the U of M JUMP: http://jump.umanitoba.ca/
Also note the instructor's web page: http://home.cc.umanitoba.ca/~mandals/ for any additional information.

Mark Breakdown:

Assignments:	10%
Presentation:	10%
Term Test 1:	15%
Term Test 2:	15%
Final:	50%

Calendar Description: (Formerly 005.459) The theory and analysis of experimental designs treated in STAT 4530 (or 005.453) and more advanced designs; construction of designs. *Prerequisite*: a grade of C or better in STAT 4530 (or 005.453) or consent of Department.

Computer Packages: Instructions will be given if the use of a software is required.

Miscellaneous: I have been asked to draw your attention to the sections in *The University of Manitoba Undergraduate Calendar* dealing with academic dishonesty, including plagiarism, cheating, and examination impersonation.

Course Contents: The following is a non-exhaustive list of topics to be covered in the course. In the beginning, you will notice that we will be revisiting some topics that you have encountered in STAT 4530. Then we will start advanced topics. Our primary goal will be to reinforce fundamental concepts, and to have a solid understanding of Experimental Design. In most instances we will also be extending the breadth and depth of the coverage.

1. PRELIMINARIES (Chapters 1, 2, 3, 4, 13)

- Basic principles of design
- Point estimates, Confidence intervals, Tests, Power functions of tests
- Bivariate and multivariate normal distributions
- Linear models
- Distributions and properties of least squares estimates
- Analysis of variance (ANOVA)
- Fixed, Random and Mixed effects models
- Derivations of expected mean squares, *F* tests
- CRD, RBD, LSD
- Split-plot designs
- Variance components

2. 2^k and 3^k FACTORIAL DESIGNS (Chapters 6, 9)

- Continuation of 2^k designs from STAT 4530
- Estimation and interpretation of main effects and interactions
- SS due to factorial effects and tests of factorial effects
- Formal tests of significance in 2^k and 3^k experiments

3. BLOCKING AND CONFOUNDING IN 2^k and 3^k FACTORIAL DESIGNS (Chapters 7, 9)

- 2^k designs in 2^b blocks - Continuation from STAT 4530
- 3^k designs in 3^b blocks
- Introduction of general notation: s^k designs in s^b blocks ($s = 2, 3$) : (s^k, s^b) designs
- Construction of (s^k, s^b) designs
- Complete and Partial confounding in (s^k, s^b) designs
- Formal tests of significance in (s^k, s^b) experiments

4. INCOMPLETE BLOCK DESIGNS (IBD) (Chapter 4)

- General incomplete block designs
- Properties of incomplete block designs
- Balanced incomplete block designs (BIBD)
- Construction and analysis of BIBD
- Properties of BIBD
- Intra-block and inter-block estimates
- Partially balanced incomplete block designs (PBIBD)

5. ANALYSIS OF COVARIANCE (ANOCOVA) (Chapter 15)

- Analysis of covariance with one or more concomitant variable(s)
- Analysis of covariance for one-way layout
- Analysis of covariance for an RBD
- Distribution of different sum of squares
- Comparison between ANOVA & ANOCOVA

6. OPTIMAL DESIGNS (Chapter 11)

- Linear design theory
- Exact and approximate designs
- Optimality criteria, Optimality conditions
- Algorithms
- Construction of optimal designs
- Optimal designs for response surface