STAT 4590 - Design of Experiments 2
Winter Term 2014
Course Outline

Instructor: Dr. Saumen Mandal

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Time, Location & CRN: Tuesdays, Thursdays 10:00 a.m. – 11:15 a.m., 316 Machray Hall. CRN: 24168.

Office Hours: Tuesdays, Thursdays: 1:00 p.m. – 2:30 p.m., or by appointment.

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*: STAT 4530 (005.453) (C) or consent of Department.

Textbook: Design and Analysis of Experiments by Douglas C. Montgomery.
8th Edition, ISBN: 978-1-1181-4692-7, John Wiley & Sons.

Some notes will be provided.

Assignments and Tests: There will be three assignments and two term tests. The dates of the term tests and final exam will be given later. The term tests and final exam are closed book. A formula sheet and relevant statistical tables will be provided if required. A non-programmable calculator will be needed. Note that graphing calculators are not permitted. There will be no make-up term test. Students who miss a term test with legitimate reasons will have the term test weight added to the final exam. All assignments are due in class. No late assignments will be accepted.
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.

Marks Breakdown:

Assignments:	20%
Term Test 1:	15%
Term Test 2:	15%
Final:	50%

Grade Cut-offs: The following are the minimum percentage grades required to receive the final grades: A+ (90%), A (80%), B+ (75%), B (70%), C+ (65%), C (60%), D (50%).

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

Academic Integrity: I have been asked to draw your attention to the sections in the *University of Manitoba Academic Calendar* regarding academic integrity and dealing with academic dishonesty including "plagiarism and cheating" and "examination personation". Links to resources that describe academic dishonesty can be found at:
umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html
umanitoba.ca/admin/governance/governing_documents/students/278.html
umanitoba.ca/calendar/

Course Contents: The following is a non-exhaustive list of topics to be covered in the course. In the beginning, we will revisit some topics that you have encountered in STAT 4530. Then we will start advanced topics. Our primary goal will be to reinforce the fundamental concepts and to have a solid understanding of Design of Experiments.

1. PRELIMINARIES (Chapters 1, 2, 3, 4, 13)
- Basic principles of design
- Bivariate and Multivariate Normal distributions
- Linear Models and its applications in Design of Experiments
- Distributions and properties of least squares estimates
- Analysis of variance (ANOVA)
- Fixed, Random and Mixed effects models
- CRD, RBD, LSD
- Derivations of expected mean squares, F tests

2. 2^k and 3^k FACTORIAL DESIGNS (Chapters 5, 6, 9)
- 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)
- Orthogonality of a design
- 2^k designs in 2^b blocks, 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

4. FRACTIONAL FACTORIAL DESIGNS (Chapter 8, 9)
- 2^{k-p} and 3^{k-p} Fractional factorial designs
- Generators, Defining Relation
- Alias Structure, Resolution

5. INCOMPLETE BLOCK DESIGNS (IBD) (Chapter 4)
- General incomplete block designs
- Least squares estimation
- Properties of incomplete block designs
- Balanced incomplete block designs (BIBD)
- Construction and analysis of BIBD

6. 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

If time permits, the following topics will be considered.

7. OPTIMAL DESIGNS (Chapter 11)
- Linear design theory
- Exact and approximate designs
- Optimality criteria, Optimality conditions, Algorithms
- Construction of optimal designs

8. SPLIT-PLOT DESIGNS (Chapter 14)