STAT 4590 – Design of Experiments 2
Winter Term 2016

Course Outline

Instructor:	Dr. Saumen Mandal
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Time, Location & CRN:	Tuesdays, Thursdays 1:00 p.m. – 2:15 p.m., 316 Machray Hall. CRN: 25449.
Office Hours:	Tuesdays, Thursdays: 11:30 a.m. – 1:00 p.m., or by appointment.
Calendar Description:	(Formerly 005.459) The theory and analysis of experimental designs treated in STAT 4530 (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 D. C. Montgomery. 8th Edition, ISBN: 978-1-1181-4692-7, John Wiley & Sons.
	Some notes will be provided.
Supplementary Reference:	Design and Analysis of Experiments with SAS by J. Lawson. ISBN: 978-1-4200-6060-7, CRC Press.
Assignments and Tests:	There will be two assignments, two midterm tests and the final exam. The dates of the midterm tests will be given later. The midterm tests and final exam are closed book. The final exam will cover the entire course. A formula sheet and relevant statistical tables will be provided if required. A non-programmable calculator will be needed. Graphing calculators are not permitted. There will be no make-up midterm test. Students who miss a midterm test with legitimate reasons will have the test weight added to the final exam. Assignments are due in class. No late assignments will be accepted.
	Information, notes, data sets and SAS codes will be posted in UM Learn System: www.umanitoba.ca/d2l

Marks Breakdown:		
	Assignments:	10%
	Midterm Test 1:	20%
	Midterm Test 2:	20%
	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:	SAS statistical software will be used to perform the analysis of experiments. Instructions will be given in the class. Data sets and SAS codes will be posted in UM Learn. There are many computers on campus that can be used for running SAS. In particular, you can practice this software in the Stats Lab at 311 Machray Hall. Opening hours are posted outside the lab. You can also install a copy of the SAS University Edition in your computer for free: www.sas.com/en_us/software/university-edition.html#for-students-learners Documentation, including installation guides: support.sas.com/software/products/university-edition/#s1=3

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/calendar

Voluntary Withdrawal: The voluntary withdrawal deadline is March 18, 2016.

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, 5, 6, 7, 8, 9, 13, 14)
- Fixed, random and mixed effects models
- Completely randomized design (CRD)
- Randomized complete block design (RCBD)
- Latin square design (LSD)
- Derivations of expected mean squares, F tests
- 2^k and 3^k factorial designs, blocking and confounding
- Fractional factorial designs
- Split-plot designs

2. LINEAR MODELS AND ITS APPLICATIONS IN DESIGN OF EXPERIMENTS
- Matrix formulation of regression and design models
- Least squares principles and estimation of parameters
- Distributions and properties of least squares estimators
- Generalized least squares

3. INCOMPLETE BLOCK DESIGNS (IBD)
- General incomplete block designs
- Least squares estimation
- Incidence and characteristic matrices
- Properties and analysis of incomplete block designs

4. BALANCED INCOMPLETE BLOCK DESIGNS (BIBD) (Chapter 4)
- Properties of balanced incomplete block designs
- Construction and analysis of balanced incomplete block designs
- Complementary design of balanced incomplete block designs

5. ANALYSIS OF COVARIANCE (ANOCOVA) (Chapter 15)
- Analysis of covariance for one-way classification
- Analysis of covariance for RCBD
- Distribution of different sum of squares
- Comparison between ANOVA & ANOCOVA

If time permits, the following topics will be considered.

6. OPTIMAL DESIGNS (Chapter 11)
- Linear design theory, exact and approximate designs
- Optimality criteria, optimality conditions
- Construction of optimal designs