University of Manitoba

Faculty of Agricultural and Food Sciences

Course Title: Non-traditional Quantitative Techniques in Soil Science Research
Department: Soil Science
Course Number: SOIL 7250
Credit Hours: 3
Academic Session: Fall 2020
Prerequisite: ANSC 7500 or instructor's permission
Classroom Location: TBD
Class Time: TF 1130 – 1300
Department Office Location: 362 Ellis Bldg
Phone Number: (204) 474-8153

Instructor Information

Name & Title: Dr. Francis Zvomuya
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Office Location: n/a
Office Phone No: (204) 474-9932
Office Hours: n/a

Course Philosophy

Students' Learning Responsibilities

It is critical that you maintain a high attendance record in order to maximize your benefits from this course. Similarly, it is important to keep up with assigned readings and participate in class discussions. The final grade will be based on class participation, presentation of assigned material, and term project; it is the student's responsibility to ensure that they optimize all three.

Why is this course useful?

The course will introduce the student to statistical techniques that are usually not covered in a typical undergraduate or graduate statistics course. Students will gain an understanding of the basis, mechanics, and applicability of various established, emerging, and innovative non-traditional statistical techniques. Importantly, students will have the opportunity to apply the techniques to their own thesis data as part of the course workload.

Who should take this course?

The course is designed for graduate students in soil science or related disciplines who are interested in a hands-on course that affords them an opportunity to use their own thesis data in assignments and projects. Students are expected to be familiar with the basic concepts of statistical design and inference. Students who are uncertain about their level of preparedness are encouraged to contact the instructor.

Course Objectives

In general, students should understand the principles and applications of non-traditional methods for analysis of soil science-related data.

In particular, at the end of the term, students will be able to:

1. Understand the principles of design and analysis of data using non-traditional techniques that are usually not covered in typical statistical courses;
2. Apply non-traditional quantitative techniques in the analysis of their data;
3. Use SAS software in the non-traditional statistical analysis of their data; and
4. Critique papers that have utilized the statistical procedures covered in the course.

Assessment

Class participation	15%
Presentations	40%
Project	45%

Description of Assignments

Students will be required to read assigned material ahead of class and give a PowerPoint presentation and a written report on their assigned topic. Assigned material will include (i) topics related to the student's research area; (ii) readings on emerging or non-traditional methodologies; and (iii) journal manuscripts/papers for review of statistical procedures employed. A short quiz may be given at any time in class, and may not be made up if missed; this will be assessed as part of class participation. Students will also work on a term-long project using data from their thesis research (if available) and present their results at the end of the term. Data sets will be provided to students who either have no data from their research or wish to work on a different data set. Periodically, students will be asked to present updates on their projects.

Assignment Due Dates

Assignment due dates will be announced at the time the assignment is handed out. **Project reports are due on the last day of class.**

Texts, Readings, Materials

Textbooks

There are no required texts for the course. Text recommendations and reading material will be provided based on the students' specific interests.

Supplementary Reading

These will be recommended based on specific topics to be covered.

Course Policies

Late Assignments
A 10% penalty will be assessed on the grade for each day after the assignment is due. No points (0%) will be awarded for submissions received after the homework is returned to the rest of the class.

Missed Assignments
If you miss a class and an assignment is given or due, it is still your responsibility to submit the assignment on time. A penalty will be assessed on late homeworks as indicated above unless a full explanation is submitted ahead of the due date explaining exactly why you will not be able to submit the assignment on the due date.

Course Outline

Topics will be selected from the following, depending on student research interests:

Introduction

- Basic concepts of experimental design and statistical analysis.

Nonlinear Regression

- This will include fitting models to kinetic, thermodynamic, sorption, mineralization; growth curves; linear-plateau models and their relatives

Partial Least Squares Regression

- Emphasis will be on applications to real data, which will be analyzed with SAS. Concepts, assumptions, applications, and hands-on interpretation of SAS output.

Generalized Linear Mixed Models

- Concepts, assumptions, applications, and applicability will be covered, with less time spent on theoretical aspects.
- Estimation methods, model checking, and hypothesis testing
- Data analysis using SAS
- Interpretation of SAS output

Repeated Measures Analysis

- Applicability (measurements repeated in time, depth, etc.)
- Covariance structures
- Analysis with SAS
- Interpretation of SAS output

Other Topics (as needed)

Additional topics will be added if there is a need.

Project

Students will work on a term project using data from their thesis research (if available). Data sets will be provided to students who either do not have their own data or wish to work on a different data set. Periodically, students will be asked to present updates on their projects. Each student will submit a report in journal style format at the end of the term and present a PowerPoint summary of the report to the class and other attendees during the last week or two of class. The report will include a research question, clearly stated objectives, corresponding hypotheses, experimental design, treatment layout, a description of statistical analyses employed, a text and graphic summary of the results, and conclusions. The rationale for the designs and statistical procedures should be clearly articulated. Students are required to attend all project presentations (attendance at the presentations and participation in the ensuing discussions will be a part of the project grade).