STAT 6344: DESIGN & ANALYSIS OF EXPERIMENTS - Syllabus

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Office hours: Tuesday and Thursday, 2:00 – 3:30 pm (walk-in). Other hours are by appointment only. Students who wish to obtain one-on-one help are strongly encouraged to make use of the appointment times.

Course Objectives
This course will introduce the students in science and engineering disciplines and those employed in industry to the design of statistically valid experiments and the proper analysis of resulting data. Both the theoretical foundations of experimental design and their application to scientific and industrial experimentation will be explored. Emphasis will be placed in introducing the students to statistical thinking that underlies the rational basis for these designs and the associated analysis. This will not be a “methods” course where recipes for various designs and analysis are handed out to the student. It should be treated as a holistic course in design of experiments, where an effort is made to inculcate the student with the statistical reasoning that underlies all the designs and their analysis.

Cooperative Learning Groups
The class will be divided into learning groups of three (or two if needed) members after the first week. Members of each group must work together sharing the workload equally. Members of each group will work together on homework and the semester project. It is expected that group collaboration will extend to the day-to-day learning of the subject matter. In-class quizzes and exams as well as take-home exams, however, must be done individually without help from group members. There will be an agreement each group will sign at the formation of the group. Distance students can form their own group or join a group of local students.

Semester Project
Each group will also work on a semester project worth a total of 50 points. Written project reports (one for each group) will be due two weeks before the finals week. The projects will be graded on eight criteria each worth five points. You can either pass or fail in each criterion receiving five or zero points for that segment. The groups will orally present their projects during the time allocated for the final exam. The oral presentation will count for up to ten points. Details about the project will be given later. Groups will have several opportunities to consult with the instructor and ensure that they are on the right track at various stages of the project. Use of these opportunities can ensure that any errors are rectified prior to submission of the project report thus avoiding the possibility of performing poorly in the project. The project will provide each student an experiential learning opportunity whereby they will receive a more intuitive understanding of the subject.
**Introductory Topics**

1. What has statistics got to do with experiments?
2. Some basic principles in experimental design and analysis
3. A quick overview of t-tests
4. Paired t-tests

**Core Topics**

1. Introduction to some common experimental designs
2. Treatment structure and design structure of an experiment
3. Randomization
4. One-way experiments in Completely Randomized Designs
5. Analysis of Variance and treatment contrasts
6. Comparison of means
7. Two-way experiments in Completely Randomized Designs
8. Analyses beyond ANOVA
9. Blocked Experiments (RCB, Latin Square)
10. Split-Plot and repeated measure designs
11. Factorial Experiments
12. Incomplete Block Designs
13. Blocking and confounding in 2k experiments
14. Blocking and confounding in factorials where S is a prime.
15. Fractional factorial experiments (2k and 3k)
16. Alias structure of a fractional factorial experiment
17. The algebra for obtaining aliasing and confounding patterns
18. Central Composite and related Designs
19. Response Surface Analysis
20. Mixture Designs
21. Use of statistical software for analyzing experimental data

Other topics may be covered based on time availability and student interests.

The mid-semester exam will be given after topic 12.

Statistical software will be available to distance students through a virtual lab through VPN. Software used are SAS, JMP, and MINITAB and prior knowledge of these packages is not required.