DESIGN OF EXPERIMENTS I ONLINE SYLLABUS

Course ID: MATH 740/840
08/26/2019 - 12/18/2019
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Course Overview
This is a one-semester course in Design of Experiments. It is the first semester of a two semester sequence with Math 744/844 being the second course in the sequence. The Math 840 designation typically for graduate student and undergraduates should enroll in Math 740. Math 840 also can be applied to the Certificate of Graduate Study in Industrial Statistics offered by the Mathematics and Statistics Department at UNH. This class is an online with no regularly scheduled class meetings. Lectures are delivered using videos and links to the appropriate videos will be posted within each course learning module. Also **many of the lectures videos will be posted on my Youtube channel** for your convenience
https://www.youtube.com/channel/UCp8OlkIlxt6NOs9GAgh1zTQ.

Prerequisite
Math 644 or equivalent introductory statistics course is a prerequisite for this course. However, for those students without the prerequisite or in need of a refresher class in statistics several introductory statistics videos and notes are available on myCourses (also known as Canvas) in the Modules area. Students are expected to review the material and are responsible for the content.

Textbook
One book is for required for the class and readings will be assigned from it and students will be required to discuss the readings (details will be posted on myCourses). The book "Optimal Design of Experiments: A Case Study Approach", by Goos and Jones (2011) is widely available through book sellers or **a free e-book is available through the UNH library**:

1. Here is a link to the free ebook version
   https://ebookcentral.proquest.com/lib/unh/detail.action?docID=697607 .

   You will be prompted for your username and password.

Software
The JMP Pro 14 statistical software is fully integrated into the course and students will need the software to complete many assignments. The software is available as a free download for UNH students and faculty. Please go to the following link and follow the directions to download and install JMP; https://td.unh.edu/TDClient/KB/ArticleDet?ID=770

Statistical Thinking for Industrial Problem Solving (STIPS)
STIPS is a new free, online course in statistics with a focus on industry that has been created by the SAS Institute (JMP is a division of SAS). Your instructor was very much involved in the design and the content of the course. You can learn about the course and watch an introductory video at the link https://www.jmp.com/en_us/statistical-thinking.html. Some of the modules in the STIPS course will be assigned as a part of this course. More details on STIPS will be provided when modules are assigned. Remember the course is free and is quite comprehensive; we will cover only a small portion of the content. For those who might be interested, if you complete all of the STIPS modules it is possible to become certified. The course also has a JMP Learning Lab where you can gain more experience in how to use JMP for analyses. You may use your own copy of JMP (preferred) doing the course or a server version is available through the course site.

Learning Objectives
Design of Experiments consists of an important set of methods whereby investigators can experiment efficiently with complex physical systems. Expertise in design of experiments is highly valued by employers across a wide range of disciplines including: manufacturing, microelectronics, chemicals, pharmaceuticals, and biotechnology; and many more. Students successfully completing the class will be able to:

- Understand and apply the fundamental concepts of experimental design.

- Know which type of design to employ for specific experimental scenarios.

- Design proper experiments for each experimental scenario.

- Properly analyze the results of their experiments and draw proper conclusions; e.g., determine which factors and interactions of factors are most important in causing variation in the system studied.

- Build statistical models that can be used to improve and optimize the behavior of physical responses under study.

- Know how to use the JMP statistical software to design experiments and analyze the results, including optimization. JMP knowledge is also a highly valued skill by many companies.

Course Structure
Again, there are no regularly scheduled class sessions. The class will be delivered through the use of recordings made by your instructor; other video resources will also be used in some of the modules.

Course Navigation	Description
Announcements Page	Regular class announcements regarding assignments, overall class progress or messages and information and reminders about upcoming events or assignments.
Syllabus Page	The syllabus, course schedule and other key class documents are located here.

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Learning Modules	This area contains the weekly Modules. The majority of course content, activities, assignments and participation is located in this area. See below for structure
Short Quizzes	Occasionally short, online quizzes will be posted on myCourses in the **Assignments** area and students will typically have a 48-hour window in which to complete the quiz. These are given to encourage students to stay engaged in the course. The quizzes are to be done individually and students are not to collaborate in completing them.
Homework	Homework will be assigned regularly to assess class learning and motivate class participation. These assignments will be posted on myCourses in the **Assignment**s area and students given sufficient time to complete them.

Module Structure	
Lecture	The lectures will primarily be made using lecture capture software and occasionally relevant Youtube videos. All videos will be made available on myCourses and/or Youtube and links provided in the associated learning module.
Resources (or Review)	PDFs of course notes will be distributed to the class via myCourses and readings from the notes will be assigned for each module.
Participation	Students are expected to participate by watching recordings in a timely fashion, read the notes available for each module, and take part in discussion forums as they are assigned.
Assignments	Graded homework assignments will be given and a final team project based on a comprehensive designed experiment will be required. All assignments are to be completed in a timely fashion and submitted electronically in PDF format through the Assignment location on myCourses. Hand written assignments are no longer accepted.

Course Schedule (This is a preliminary schedule for planning purposes only, actual coverage and assignments may vary during the semester)

Week	Date	Topics Covered	Assignments and Due Dates
One Modules 1A/B	Aug 26 – Sep 02	Introduction to DOE Basic Statistics Learn JMP	• Watch assigned videos on DOE, basic statistics and introduction to JMP • Do assigned readings • Complete Quiz on these topics • Complete Discussion Forum on Problem Solving and Engineering
Two & Three Module 2	Sep 02 – Sep 16	Principles of ANOVA and One factor experiments Part	• Watch assigned videos lectures on one factor experiments and ANOVA. • Do assigned readings • Complete a homework assignment #1 • Complete Quiz #2
Four Module 3	Sep 16 – Sep 23	Multiple Comparisons for One Factor Experiments	• Watch assigned videos for this topic • Do assigned readings • Complete Quiz #3 • Complete Discussion Forum on Lady Tasting Tea
Five Module 4	Sep 23 – Sep 30	Blocking in one factor Experiments, Measurement Systems Analysis	• Watch assigned videos on thses topic • Do assigned readings • Complete a homework assignment #2 • Complete discussion forum on Saving Millions with Analytics
Not covered this semester Module 5		General Factorial Experiments	• Watch Assigned videos for this topic • Do assigned readings • Complete Quiz on this topic
Six Module 6	Sep 30 – Oct 07	2 Level Full Factorial Experiments	• Watch Assigned videos for this topic • Do assigned readings • Begin Paper Helicopter midterm project
Seven & Eight Module 7	Oct 07 – Oct 21	2 Level Fractional Factorial Experiments	• Watch Assigned videos for this topic • Do assigned readings • Turn in Paper Helicopter Report
Nine Module 8	Oct 21 – Oct 28	Mixture Designs and Incomplete Blocking	• Watch Assigned videos for this topic • Do assigned readings • Complete homework assignment #3 • Final project assigned
Ten Module 9	Oct 28 – Nov 04	Screening Designs	• Watch Assigned videos for this topic • Do assigned readings • Complete a homework assignment #4 • Complete quiz on screening designs
Eleven Module 10	Nov 04 – Nov 11	Screening Designs Continued	• Watch Assigned videos for this topic • Do assigned readings

			• Complete homework assignment #5
Twelve Module 11	Nov 11 – Nov 18	Response Surface Methods	• Watch Assigned videos for this topic • Do assigned readings
Thirteen Module 12	Nov 18 – Nov 25	Definitive Screening Designs	• Watch Assigned videos for this topic • Do assigned readings • Complete a homework assignment #6
Fourteen Module 13	Dec 02 – Dec 09	Split Plot Design Structures and catchup if needed	• Watch Assigned videos for this topic • Do assigned readings
Fifteen	Final Project	Complete work on final project and turn in write up.	**The final project report is due by the end of day Dec 11th. ** Further details will be provided during the semester**.**

Grading Scheme

Item	% or points	Requirements
Quizzes	10%	Number of quizzes will be determined during the semester
Class Participation	5%	Participation in Discussion forums when assigned.
Homework	30%	Your solutions for the homework are to be submitted electronically via myCourses. The submitted assignment must be in PDF format. To submit the homework via myCourses, go to the original assignment to open it, and you will see an option to upload files.
Mid Term Project	25%	You will be assigned a group project to perform an experiment provided to you. The team must perform the experiment, analyze the results, and submit a written report. Detail will be provided during the semester.
Final Project	30%	Design, run, and correctly analyze an experiment of your own design. The project may be done as a team.

Projects:

There is a midterm project (the helicopter experiment) and a final project. Both projects are team projects. Although individuals may complete the projects, team work is strongly encouraged. The midterm project involves performing an experiment designated by your instructor. The final project is based upon an experiment of your choosing and more details will be published during the semester.

Submitting Homework and Project Reports:
Your solutions for the homework and projects are to be submitted electronically via myCourses; simply upload your completed assignment through the original assignment posted on myCourses. Electronic submittals for regular homework **must be in PDF format.** Uploading the homework and project solutions through myCourses is important for grading purposes. Note, handwritten assignments are no longer accepted.

Policy on Late Submissions and Quizzes
- An assignment can be submitted late up to one week after the due date if sufficient reason is given for the lateness.
- Quizzes deployed through myCourses will be locked after the due date and will not be reopened, so students must complete the online quiz within the allotted time and typically will be given two opportunities to complete each quiz.

Student to Instructor Communication Expectations

Questions related to assignments should be directed to me or the teaching assistant via email or during office hours. Email communication should be concise and focused as we tend to receive a great deal of email and do not have the bandwidth to read long rambling communications. As an example, if you have a homework question clearly state the exact item (in words) in the homework (do not just say question 2) you have a question about and be very clear as to what you want to know. Of course, we will not give explicit answers to homework problems so questions should be for clarification or direction in working to a solution. Also, please do not send attachments via email asking us to examine partial or complete solutions to homework for correctness. We will not provide feedback on such attachments if they are sent.

University Disability Accommodations
The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, you must register with Disability Services for Students (DSS). Contact DSS at (603) 862-2607 or disability.office@unh.edu. If you have received Accommodation Letters for this course from DSS, please provide me with that information privately in my office so that we can review those accommodations. Of course, you should always feel free to discuss any disability issues with me and all such conversations are kept in strict confidence.

Emotional or Mental Health Distress: Your academic success in this course is very important to me. If, during the semester, you find emotional or mental health issues are affecting that success, please contact the University's Counseling Center (3 rd fl, Smith Hall; 603 862-2090/TTY: 7-1-1), which provides counseling appointments and other mental health services .

Academic Honesty and Plagiarism
Students are required to abide by the UNH Academic Honesty as described in the student handbook.   Students are expected to submit their own original work and further guidelines will be issued with specific assignments during the semester; plagiarism will not be tolerated,

especially copying homework from one another and cheating on quizzes. The rules will be enforced. Here is an important link on academic honesty