

## IE 5352: Design and Analysis of Industrial Experiments (ONLINE)

CRN: 11563

Fall 2020

Dr. Jaime Sanchez

Office E226C

Class meets in Blackboard Collaborate Ultra on Wednesdays from 6:00 to 8:50 pm.

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Office Hours Skype: Tuesday from 9:00 to 10:20 am, Wednesday from 4:30 to 6:00 pm and Thursday from 12 noon to 1:30 pm or By Appointments.

### Course Description

The relationship between the scientific method and the Design of Experiments (DOE) is stated at the beginning of the course and is enforced every possible way to show that DOE is the core element of the scientific research. Both design and statistical analysis issues are discussed. Opportunities to use the principles taught in the course arise in all phases of engineering and scientific work, including technology development, new product and process development, and manufacturing process improvement.

This course is a computer based notes with a large variety of examples real-world applications drawn from different fields of engineering and sciences. Forty percent of the class time should be spent with the computer to take advantage of the time by minimizing calculation time and maximizing the time to interpret the results and make conclusions. Also the technology is used to make communication more efficient and have information available for the students in all the time. Therefore, the student will conceptualize the link among basic concepts and strong conclusions.

The main topics cover in DOE are: Strategy of experimentation, Basic principles, guide lines for designing an experiment, Experiments with a single factor, Model Adequacy checking, Post analyses of variance analyses, Blocking designs, General factorial designs, Factorial  $2^k$ , and fractional factorial Designs.

### Course Objectives or Expected Learning Outcomes

At the end of this course, students will be able to:

- Understand the basic concepts about design and analysis of experiments;
- Plan, conduct and analyze an experiment that lead the system to better operating conditions;
- Apply concepts and statistical methods in order to draw conclusions about industrial systems;
- Collect information from well-planned experiments make inference about industrial systems;
- Develop an iterative approach to reach the best possible operating conditions in industrial system.



are working a related field previous professor approval. Also the student ought to submit at least 10 of 12 assignments and take the two quizzes during the semester.

The term project is performed in teams of up to three people. The project consists of planning, designing, conducting and analyzing an experiment, using appropriate DOE principles. Two written interim project reports are required, along with a final written project report. Due dates will be announced during lecture time.

### **Attendance Policy**

Because this is an online course, attendance is determined by class participation online. Students must be prepared, participate in online individual/group discussions. To preserve a student's GPA, he/she WILL be dropped from the course for failure to turn in three or more major assignments.

### **Technology Requirements**

Course content is delivered via the Internet through the Blackboard learning management system (LMS). Ensure your UTEP e-mail account is working and that you have access to the Web. You may use any of the primary Web browsers—Explorer, Google Chrome, Firefox, Safari, etc. When having technical difficulties, try switching to another browser.

You will need to have or have access to a computer/laptop, printer, scanner, a webcam, and a microphone. You will need to purchase a USB (flash drive). You will need to download or update the following software: Microsoft Office, Adobe, Flash Player, Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course. **If you encounter technical difficulties of any kind, contact the [Help Desk](#).**

### **Online Etiquette (Netetiquette)**

- Always consider audience. Remember that members of the class and the instructor will be reading any postings.
- Respect and courtesy must be provided to classmates and to instructor at all times. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a F2F situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space. If students wish to do so, they have the ethical obligation to first request the permission of the writer(s).
- For further information consult Online etiquette at <https://potomac.edu/netiquette-rules-online-students/>

## Late Work Policy

### Major Assignments

- Major assignments will be due on Wednesdays at midnight (11:59 PM). No late work will be accepted after a week of due date. No submitted assignments will be graded with zero.

### Quiz and Discussion Assignments

- All quiz, and discussion board assignments will be due on Monday at midnight (11:59 PM). No late work will be accepted.

## Drop Policy

To drop this class, please contact the [Registrar's Office](#) to initiate the drop process. If you cannot complete this course for whatever reason, please contact me. If you do not, you are at risk of receiving an "F" for the course.

## Accommodations Policy

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#).

## Scholastic Integrity

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more [HOOP: Student Conduct and Discipline](#).

## Student Resources

UTEP provides a variety of student services and support:

- [UTEP Library](#): Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.

- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.
- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [Military Student Success Center](#): UTEP welcomes military-affiliated students to its degree programs, and the Military Student Success Center and its dedicated staff (many of whom are veterans and students themselves) are here to help personnel in any branch of service to reach their educational goals.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

### Weekly Calendar (Subject to Change)

IE 5352 Design and Analysis of Industrial Experiments of Experiments  
CRN: 11563

**DOE= Design of Experiments; BB=Blackboard.**

Week	Topic	Text Reference Readings Due	Notes
1	Syllabus Review, Introduction to DOE, begin review of basic statistical concepts. The <i>t</i> -test and confidence intervals.	Chapters 1 & Chapter 2 (Sections 2.1 through 2.4).	Video <i>t</i> -test and BB Collaborate Ultra Presentations.
2	Review of basic statistical concepts. The <i>t</i> -test and confidence intervals. <b>Quiz 1</b>	Chapter 2 (Sections 2.1 through 2.4).	Video <i>t</i> -test and BB Collaborate Ultra Presentations.
3	Introduction to the analysis of variance (ANOVA), Some practical aspects of planning experiments. residuals and model adequacy checking of basic assumptions: Anderson-Darling and Barlett's tests and Transformations.	Chapter 3 (Sections 3.1, 3.2, and 3.3) Suggested reading: Coleman, D. E. and Montgomery, D. C. (1993), "Planning for a Designed Industrial Experiment", <i>Technometrics</i> 35(1), pp. 1-12 (also on BB).	View the video on planning experiments that is in BB.
4	More about ANOVA and multiple comparisons.	Sections 3.4, 3.5, and 3.6, 3.8.	BB Collaborate Ultra Presentations.
5	Kruskal-Wallis Method and Randomized Complete Block Design.	Sections 3.11 and 4.1.	BB Collaborate Ultra Presentations.
6	Randomized Complete Bock and Friedman's test.	Material Provided in Backboard on Friedman's Test.	BB Collaborate Ultra Presentations.
7	<b>Exam 1</b>	Sections covered in Chapters 1, 2 and 3.	BB Collaborate Ultra

8	Factorial Designs and Project Discussion.	Chapter 5: Sections 5.1, 5.2, 5.3 and 5.4.	BB Collaborate Ultra Presentations.
9	2 <sup>k</sup> Factorial Design.	Chapter 6: sections 6.1, 6.2, 6.3, 6.4, 6.5 and 6.6.	Video and BB Collaborate Ultra presentations.
10	Fractional Factorial. <b>Quiz 2</b>	Chapter 8: Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6 and 8.7.	Video and BB Collaborate Ultra presentations.
11	Fitting Regression Models.	Chapter 10: Sections 10.1, 10.2, 10.3, 10.4, 10.5.	BB Collaborate Ultra Presentations.
12	<b>Exam 2</b>	Sections covered in Chapters 4, 5, 6 and 8.	BB Collaborate Ultra Presentations.
13	Response Surface Designs.	Chapter 11: Sections 11.3 and 11.4.	BB Collaborate Ultra Presentations.
14	Robust Designs.	Chapter 12: Sections 12.1, 12.2, 12.3 and 12.4.	BB Collaborate Ultra Presentations.
15	<b>Exam 3</b>	Sections covered in Chapters 10, 11 and 12.	BB Collaborate Ultra Presentations.
16	<b>Term Project</b> <b>Final Exam</b>	Sections covered in Chapters 5, 6, 8, 10, 11 and 12.	BB Collaborate Ultra Presentations.