DATE PREPARED: August 1th, 2019
PREPARED BY: Dr. Hector R. Siller

COURSE NUMBER, TITLE, CREDIT HOURS:

MSET 5020, Design of Experiments, 3 hours

DESCRIPTION:

A study of industrial analytical techniques used to develop new products and new technologies, including the use of engineering software for design purposes.

PREREQUISITES:

Basic knowledge of statistics.

RECOMMENDED TEXTBOOKS:

Montgomery, D. C., & Runger, G. C. (2013). Applied statistics and probability for engineers. John Wiley & Sons. ISBN: 978-1-118-80225-0

Levine, D. M. (2006). Statistics for Six Sigma Green Belts with Minitab and JMP. Pearson Education Inc. ISBN-13: 978-0137017126

COURSE OBJECTIVES

1. To introduce the student to methods of design of experiments used in industrial research trends like Design for Six Sigma and Taguchi Philosophy.
2. To enable students to work with statistical software for performing design and analysis of experiments.
3. To allow students to develop their own ideas into processes and products in a technological way.

STUDENT LEARNING OUTCOMES:

Upon successful completion of this course, the learner will be able to:

1. Apply mathematical statistical techniques to different contexts in engineering practice, to analyze the design process of products and services.
2. Plan, model and design experiments using engineering software for design purposes.
3. Apply the optimization of variables with design of experiments and statistical techniques, for their use in product and process improvement in industrial scenarios.
4. Understand how industrial design of experiments methodologies like Design for Six Sigma and Taguchi Philosophy could benefit product and process development processes.

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Engineering Technology

COURSE OUTLINE:

Note: The instructor reserves the right to substitute appropriate material for this class besides the topics covered in this outline.

Module	Module-level Learning Objectives Upon successful completion of this module, the learner will be able to:	Learning Materials	Activities/Interactions	Assessments
Week 1	Read and download the course syllabus. Navigate the Learning Management System. Learn the Fundamentals of Design of Experiments (DOE).	Course Syllabus Start here module	Review Presentation #1: DOE Fundamentals Discussion #1: Introduction	Diagnostic exercise
Week 2	Understand descriptive statistics for constructing and interpreting visual data displays. Complete an exercise on descriptive statistics.	Chapter 6 of the textbook Minitab Basic Statistics and Graph Modules Datasets	Review Presentation #2: Descriptive Statistics Discussion #2: Descriptive Statistics	Exercise on descriptive statistics
Week 3	Use linear and multiple regression techniques for building empirical models to engineering and scientific data. Complete an exercise on regression techniques.	Chapter 11 and 12 of the textbook Minitab Regression Module Datasets	Review Presentation #3: Regression techniques Discussion #3: Regression techniques	Exercise on regression techniques
Week 4	Design and conduct engineering experiments involving a single factor with an arbitrary number of levels. Complete an exercise on design of experiments involving single factor.	Chapter , 13-1 and 13-2 of the textbook Minitab ANOVA Module Datasets	Review Presentation #4: DOE with single factor Discussion #4: DOE with single factor	Exercise on DOE single factor
Week 5	Understand the difference between fixed and random factors. Estimate variance components in an experiment involving random factors. Complete an exercise on design of experiments involving random factors.	Chapter 13-3 of textbook Minitab ANOVA Module Datasets	Review Presentation #5: DOE random factors Discussion #5: DOE random factors	Exercise on DOE random factors
Week 6	Design and conduct experiments involving the randomized complete block design. Complete an exercise in experiments on randomized complete block design.	Chapter 13-4 of textbook Minitab ANOVA Module Minitab DOE Module Datasets	Review Presentation #6: DOE block design Discussion #6: DOE block design	Exercise on DOE block design
Week 7	Demonstrate superior knowledge on descriptive statistics and design of experiments involving a single factor. Complete practice exercises. Complete the Middle Term Examination.	Previous exercises from Week 2 to 6 Datasets	Review Presentation #7: Middle Term Review Middle Term Examination activity	Integral exercise Middle Term Examination

Week 8	Design and conduct experiments involving several factors using the factorial design approach. Complete an exercise on factorial design approach.	Chapter 14-1 to 14-4 of textbook Minitab DOE Module Datasets	Review Presentation #8: Factorial DOE Discussion #7: Factorial DOE	Exercise on factorial DOE
Week 9	Know how to use the two-level series of factorial designs. Understand how to run two-level factorial design in blocks. Complete an exercise on two-level factorial design.	Chapter 14-5 and 14-6 of textbook Minitab DOE Module Datasets	Review Presentation #9: Two-level factorial DOE Discussion #8: Two-level factorial DOE	Exercise on two-level factorial DOE
Week 10	Design and conduct experiments involving several factors using the fractional factorial design approach. Complete an exercise on fractional factorial design.	Chapter 14-7 of textbook Minitab DOE Module Datasets	Review Presentation #10: Fractional factorial DOE Discussion #9: Fractional factorial DOE	Exercise on fractional factorial DOE
Week 11	Use Response Surface Methodology (RSM) for process optimization experiments. Complete an exercise on Response Surface Methodology.	Chapter 14-8 of textbook Minitab DOE-RSM Module Datasets	Review Presentation #11: RSM Discussion #10: RSM	Exercise on RSM
Week 12	Understand the principles and tools for improving the design process according to DFSS (Design for Six Sigma). Complete a quiz on Six Sigma Philosophy.	DFSS research papers posted online	Review Presentation #12: DFSS Presentation from students #1: DFSS	Paper on DFSS Quiz on DFSS
Week 13	Know how to implement design of experiments in Design for Six Sigma Philosophy. Complete an exercise on applying statistical tools to analyze and improve the design process according to DFSS.	DFSS research papers posted online Minitab DOE-RSM Datasets	Review Presentation #13: DFSS Discussion #11: DFSS	Exercise on DFSS
Week 14	Know how to implement design of experiments in Taguchi Philosophy Complete a quiz on Taguchi Philosophy.	Taguchi research papers posted online	Review Presentation #14: Taguchi Presentation from students #2: Taguchi	Paper on Taguchi Quiz on Taguchi
Week 15	Complete an exercise on applying statistical tools to analyze and improve the design process according to Taguchi. Demonstrate abilities and knowledge in design of experiments through a final project report.	Taguchi research papers posted online Minitab DOE-RSM Datasets	Review Presentation #15: Taguchi Discussion #12: Taguchi	Exercise on Taguchi DOE Final Project report
Week 16	Demonstrate superior knowledge on design of experiments using factorial design approach and its implementation in the industry. Complete the Final Examination.	Previous exercises from Week 8 to Week 15 Datasets	Review Presentation #16: Final Term Review Final Examination activity	Final Examination

GRADING ELEMENTS AND WEIGHTS:

Individual Project	30%
Homework and Quizzes	25%
Midterm Examination	20%
Final Examination	25%
TOTAL	100%

GRADING POLICIES:

a. Quizzes and examinations are graded based on class performance.
b. Formal evaluations will consist of quizzes, two examinations and project presentation.
c. The instructor reserves the right to alter the syllabus.

90% to 100%	A
80% to 89.99%	B
70% to 79.99%	C
60% to 69.99%	D
Below 60%	F

CLASS POLICIES:

a. All rules relating to academic dishonesty will be enforced in accordance with University policies. Cheating on quizzes, examinations and laboratory assignments, and plagiarism on various papers and reports are types of disciplinary misconduct for which penalties are assessed under the UNT Code of Student Conduct and Discipline. Major responsibility for implementing the University's policy on scholastic dishonesty rests with the faculty. Be advised that the instructor of this course supports and fully implements this policy. The following actions will be taken when evidence of such misconduct is observed. The student will be presented with the evidence of misconduct and given an opportunity to explain same. Based on the outcome of this private conference, the matter will be either dropped or the student will be given a grade of "F" in the course and be referred to the Dean of Students for further counseling and/or disciplinary action.
b. During the course, handouts will be provided to enhance the presentation of certain concepts. These materials are provided strictly for instructional purposes and may otherwise be restricted. There is no authorization for further reproduction of distribution of handout materials beyond that intended to teach the course.
c. This syllabus is subject to change at any time during the semester with changes to be announced in class.
d. Each student should retain graded lecture notes, pop quizzes, homework, tests, software-generated files, and laboratory reports to document errors in recorded grades.
e. Requests for review of graded work must be submitted during the lecture in which such work is returned to the students. The request should be accompanied by a written justification of the request including any supporting data.
f. There is no limit to the use of calculators and computers for lecture, labs, pop quizzes, formal tests, or final examination. However, the use of cell phones during the class is not allowed, except in the case of an emergency.
g. Challenges to the course grade must be presented within 60 days of receipt of grade notices mailed by the university. This will insure that instructor's records are still available to allow a review of the assigned grade. You should first discuss your complaint with the instructor. If you wish to carry it further, contact the Program Coordinator by calling (940) 565-2022. To further pursue your complaint, contact the Department Chair at (940) 565-2022, but ONLY after first discussing your concern with the previous two individuals.
h. An I (incomplete) grade is given only for extenuating circumstances and in accordance with University and Departmental Policies.