MATH410

Course Summary

Course : MATH410 **Title :** Design of Experiments
Length of Course : 8
Prerequisites : MATH340 **Credit Hours :** 3

Description

Course Description: This course is delivered online and is organized into distinct parts. This course will begin with Design of Experiments (DOE) methodology and statistical inference. The design of single factor, factorial, nested and nested factorial experiments will be taught. Quantitative and qualitative factors will be introduced to simulate real situations that are encountered in operations being explored. Students will learn how to set up and solve fixed, random, and mixed models with two or more factors. Practical applications are provided throughout the course. (Prerequisite: MATH340)

Course Scope:

This course introduces concepts in planning, conducting, and analyzing statistically designed experiments. The purpose of these experiments is to design or improve products and processes. The techniques that will be taught include Analysis of Variance (ANOVA), tests of hypotheses, confidence interval estimation, and other statistical methods. The methods
taught are used to set values for design, process, and/or control factors so that designs and product improvements can be optimized, even when outside factors or influences are present in the system.

Objectives

After successfully completing this course, you will be able to:

- CO-1 Evaluate completely randomized designs;
- CO-2 Analyze randomized blocks and related designs;
- CO-3 Analyze 2^k factorial designs;
- CO-4 Evaluate factorial designs (fixed, random, and mixed effects models);
- CO-5 Evaluate nested designs;
- CO-6 Evaluate split-plot designs;
- CO-7 Analyze regression models;
- CO-8 Use multiple comparison techniques to draw simultaneous inference about parameters; and
- CO-9 Use residual analysis to check for violation of the model assumptions.

Outline

Week 1: Overview to Design of Experiments; Basic Principles

Learning Objectives

CO-1: Evaluate completely randomized designs;

CO-8: Use multiple comparison techniques to draw simultaneous inference about parameters; and

CO-9: Use residual analysis to check for violation of the model assumptions.

Readings

Text Readings: Montgomery, Chapters 1 and 2

In Course Materials: Week 1: Overview and Basic Principles

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #1 Forum Posts; Topics 1

Assignment #1

Week 2: Simple Designs and Analysis of Variance

Learning Objectives

CO-2: Analyze randomized blocks and related designs;

CO-8: Use multiple comparison techniques to draw simultaneous inference about parameters; and

CO-9: Use residual analysis to check for violation of the model assumptions.

Readings

Text Readings: Montgomery, Chapter 3

In Course Materials: Week 2: Simple Designs and Analysis of Variance

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #2 Forum Posts; Topic 2

Test #1

Assignment #2

Week 3: Block Designs, Latin Squares, Factorial and Related Designs

Learning Objectives

CO-2: Analyze randomized blocks and related designs; and

CO-4: Evaluate Latin Squares, Factorial and Related Designs Additional Student Material at Montgomery Student Companion Site

Readings

Text Readings: Montgomery, Chapters 4 and 5

In Course Materials: Week 3: Block Designs, Latin Squares, Factorial and Related Designs

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #3 Forum Posts; Topic 3

Assignment #3

Week 4: 2^k Factorial Designs

Learning Objectives

CO-3: Analyze 2^k factorial designs; and

CO-4: Evaluate factorial designs (fixed, random, and mixed effects models).

Readings

Text Readings: Montgomery, Chapters 6 and 7

In Course Materials: Week 4: 2^k Factorial Designs

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #4 Forum Posts; Topic 4

Assignment #4

Test #2

Week 5: Two-Level Full Factorial and Fractional Factorial Designs

Learning Objectives

CO-3: Analyze 2^k factorial designs; and

CO-4: Evaluate factorial designs (fixed, random, and mixed effects models).

Readings

Text Readings: Montgomery, Chapter 8

In Course Materials: Week 5: Two-Level Full Factorial and Fractional Factorial Designs

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #5 Forum Posts; Topic 5

Assignment #5

Week 6: Additional Topics in Factorial and Fractional Designs and Fitting Regression Models

Learning Objectives

CO-3: Analyze 2^k factorial designs;

CO-4: Evaluate factorial designs (fixed, random, and mixed effects models); and

CO-7: Analyze regression models.

Readings

Text Readings: Montgomery, Chapters 9 and 10

In Course Materials: Week 6: Additional Topics in Factorial and Fractional Designs and Fitting Regression Models

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #6 Forum Posts; Topic 6

Assignment #6

Test #3

Week 7: Designs with Random Factors, Nested and Split-Plot Designs

Learning Objectives

CO-1: Evaluate completely randomized designs;

CO-2: Analyze randomized blocks and related designs;

CO-5: Evaluate nested designs; and

CO-6: Evaluate split-plot designs.

Readings

Text Readings: Montgomery, Chapters 12, 13 and 14

In Course Materials: Week 7: Designs with Random Factors, Nested and Split-Plot Designs

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #7 Forum Posts; Topic 7

Assignment #7

Week 8: Other Design and Analysis Topics and Course Review and Final Examination

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Learning Objectives

CO-4: Evaluate factorial designs (fixed, random, and mixed effects models); and

CO-1 through CO-9

Readings

Text Readings: Montgomery, Chapter 15

In Course Materials: Week 8: Other design and Analysis Topics

Additional Student Material at [Montgomery Student](#) [Companion Site](#)

Assignment

Week #8 Forum Posts; Topics 9 and 10

Assignment #8

Test #4

Evaluation

Reading Assignments:

Please refer to the Course Outline section of this syllabus for the weekly reading assignments. While reading assignments are not graded, it is very important that you read the assigned material and work practice problems as necessary and appropriate.

Forum Assignments:

The forums are designed for students to provide information and ask questions on course content for the week. Your forum posts must meet the minimum requirement for the number of posts and the content for that assignment. These forums should not be used to discuss specific exam questions, but can be used to ask questions relative to practice exercises, practice tests, and textbook problems.

Three significant posts are required per forum. Posts should be made as indicated in the forum instructions. Be sure to click on the link "Read Full Description" so that you will be familiar with each forum requirement and the grading rubric. (A significant post generally contains at least 100 words for a response —single sentence responses such as "Now I understand" or "Thank you for your help" do not constitute significant posts and 250 words for an initial forum post.)

Grading for each forum will follow the point structure outlined in the description for each forum.

Introduction Forum – Topic 1: It is very important that you submit and participate in the Introduction Forum. Please introduce yourself to me and the class. Share where you work or plan to work after completing your program, your family, and any hobbies or special interests. Also tell us why you are taking this course and what you hope to gain from obtaining your degree. In addition, please take a look at the course objectives in the syllabus and discuss the relevance to your career goals.

Instructions: Your initial post should be at least 250 words. Please respond to at least 2 other students. Responses should be a minimum of 100 words. This forum submission serves as your official entry into the course and this is why we have drawn special attention to this assignment. You will be reminded of this Forum again in the Week 1 Lesson, but please keep in mind that this Introduction Forum must be submitted

by 11:55 p.m., ET, on Sunday of Week 1 to maintain your registration in the course.

Homework Practice Problems and Practice Tests:

Please be sure to ask each other (and/or your professor) questions about practice problems, practice test questions or other textbook material in the Open Questions Forum! Please do not divulge only answers, but provide assistance in developing solutions for problems as well. This will help you learn through explaining and help your classmates find where they are missing the point. Teamwork is encouraged in working practice problems so that you can learn through sharing problem-solving techniques. If you are unsure of a problem, please ask about it in the Open Questions Forum so that everyone can share in the conversation.

Numbered Tests:

Numbered tests are found via the navigation link labeled "Tests & Quizzes." Please complete each test by the due date noted in the syllabus and in the classroom. These are open-book and open-note tests, but are not collaborative efforts. They are timed, so be sure that you have the appropriate time available before you enter each test. These are single-access tests. Once you have accessed the test, it cannot be made up.

Field Experience Assignments:

Assignments may be included which are associated with field experiences. These are found in the "Assignments" section of your classroom.

The points earned on the graded course assignments will determine the course grade. The final grade in the course will be based on total points. Grades will be assigned based on the following composite scores:

Grading:

Name	Grade %
Academic Integrity	1.00 %
Academic Integrity Honor Pledge	1.00 %
Assignments	32.00 %
Assignment 1: Overview to Design of Experiments and Basic Principles	4.00 %
Assignment 2: Simple Designs and Analysis of Variance	4.00 %
Assignment 3: Block Designs, Latin Squares, Factorial and Related Designs	4.00 %
Assignment 4: 2k Factorial Designs	4.00 %
Assignment 5: Two Level Factorial and Fractional Factorial Designs	4.00 %
Assignment 6: Additional Topics in Factorial Designs and Fitting Regression Models	4.00 %
Assignment 7: Designs with Random Factors, Nested and Split-Plot Designs	4.00 %
Assignment 8: Other Design and Analysis Topics	4.00 %
Forums	36.00 %
Week 1 - Topic #1	4.00 %
Week 2 - Topic #2	4.00 %
Week 3 - Topic #3	4.00 %
Week 4 - Topic #4	4.00 %
Week 5 - Topic #5	4.00 %

Week 6 - Topic #6	4.00 %
Week 7 - Topic #7	4.00 %
Week 8 - Topic #8	4.00 %
Week 8 - Topic #9	4.00 %
Unit Tests	32.00 %
Unit Test 1, Part A	4.00 %
Unit Test 1, Part B	4.00 %
Unit Test 2, Part A	4.00 %
Unit Test 2, Part B	4.00 %
Unit Test 3, Part A	4.00 %
Unit Test 3, Part B	4.00 %
Unit Test 4, Part A	4.00 %
Unit Test 4, Part B	4.00 %

Materials

Book Title: Design and Analysis of Experiments, 8th Ed - The VitalSource e-book is provided via the APUS Bookstore

Author: Montgomery

Publication Info: Wiley

ISBN: 9781118146927

Book Title: You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - http://apus.libguides.com/bookstore/undergraduate

Author: N/A

Publication Info: N/A

ISBN: N/A

Design and Analysis of Experiments, 8th Ed - The VitalSource e-book is provided via the APUS Bookstore. All students have access to the e-Book (ISBN 978-1-1183-2426-4); a link is located on the left hand navigation bar of the home page. A copy is also located in the "Lessons" link--each individual chapter in the textbook is listed as a separate PDF file. Access can also be gained by clicking on the book cover located on the home page.

You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available at http://apus.libguides.com/bookstore/undergraduate.

Students will need access to a statistics software package. Minitab is recommended but any application may be used. Students may make use of statistical software for all graded assignments and exams during the course.

In addition to the required course texts, the following public domain websites are useful. Please abide by the university's academic honesty policy when using Internet sources as well. Also website addresses are subject to change.

Web Sites:

In addition to the required course texts, the following public domain web sites are useful. Please abide by the university's academic honesty policy when using Internet sources.

Site Name	Website URL/Address
Minitab Blog	http://blog.minitab.com/blog/design-of-experiments-2
The Khan Academy	https://www.khanacademy.org/math/probability

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Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- Tutor.com offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general,

standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- "Substantive" means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says "I agree" is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

Student Handbook

- Drop/Withdrawal policy

- Extension Requests

- Academic Probation

- Appeals

- Disability Accommodations

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.