Philadelphia University
Faculty of Science – Department of Basic Sciences and Mathematics
Summer Semester 2009–2010

Course Syllabus

Course Title	Design of Experiments	**Course Code**	210331
Course Level	"3" (Elective Course)	**Course Prerequisite**	210232
Lecture Time	SMTWT 08:00–09:00	**Credit Hours**	"3"

Academic Staff Specific

Name	Feras Awad Mahmoud		
Rank	Lecturer "M.Sc"		
Room Number	"819", Office Ext. No. (2341)	**Office Hours**	09:00 – 10:00 SMTWT; other times by appointment.
Location	Faculty of Science		
E – mail	fawad@philadelphia.edu.jo		

Course Description:

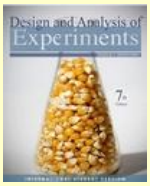
This is a basic course in designing experiments and analyzing the resulting data. The course deals with the types of experiments that are frequently conducted in industrial settings. The prerequisite background is a basic working knowledge of statistical methods. You will need to know how to compute and interpret the sample mean and standard deviation, have previous exposure to the normal distribution, be familiar with the concepts of testing hypotheses (the *t*–test, for example), constructing and interpreting a confidence interval, and model–fitting using the method of least squares. Most of these ideas will be reviewed as they are needed. Students completing the course are expected to be knowledgeable in the basic experimental designs. Materials covered in the course include *Introduction to Statistics and Data Analysis*, *Inferential Data Analysis for Simple Experiments*, *One Factor Designs*, *One Factor Blocking Designs*, *Latin Square Designs*, *Two- and General Factor Factorial Experimental Designs*, 2^k *Factorial Designs*.

Course Objectives:

The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. 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 design and development, process development, and manufacturing process improvement. Computer software package, *Minitab 15* (http://www.minitab.com), to implement the methods presented will be illustrated extensively, and you will use this package for homework assignments.

Course Components (Text Book):

Title	:	Design and Analysis of Experiments.
Author	:	D. C. Montgomery
Publisher	:	John Wiley & Sons, Inc.
Edition	:	7th Edition.
Year	:	2009
ISBN	:	978-0-470-45687-3



Module References:

The course schedule and outline contains assigned reading topics from the textbook and suggested homework problems. In addition to the textbook reading assignments you may also want to read some of the supplemental text material for each chapter. This material is found on the World Wide Web page for the book maintained by the publisher, John Wiley & Sons.

http://bcs.wiley.com/he-bcs/Books?action=resource&bcsId=4613&itemId=0470398825&resourceId=14570.

Teaching Methods:

1. To learn it is imperative for the student to take an active interest in their own education. To learn mathematics the student must read, think, and write in an analytical manner and this takes practice. Such practice is by working exercises. When troubles arise, and they will, the student must ask questions. Questions may be posed to the instructor or to other students in a variety of ways; online office hours, or in class.
2. There are many different styles of learning. Some people gain better understanding from listening to something being explained orally. Some get better understanding from written material. Some like a combination of both. I

do my best to accommodate various styles of learning. However, feel free to let me know what your learning style is so that I can take that into account when determining the future direction of the course.

3. There will be required readings associated with each lecture. Most readings will be from the course text, but students are encouraged to seek supplementary material. Links to supplementary reading material can be accessed from the course page.
4. Homework will be assigned each week; not to be collected or graded by the instructor. In addition, at the end of a chapter, challenge problems will be assigned for "work–hard "students. Furthermore, mathematical projects on real–life problems will be assigned to the students throughout the semester.
5. I encourage the use of research materials as a way to supplement your understanding of the course material, as long you heed the following common-sense ground rules. First, you may not consult my solutions or the problems sets of other students from previous offerings of this course. Second, external sources may be used only to improve your own understanding. You may not quote directly from any source and you should not write down anything that you do not understand. When you write your solutions, you should do it on your own without the direct help of any external sources. If you do use external references in improving your understanding, please cite them! Failure to cite references will be treated as cheating and will not be tolerated. If you are diligent about citing references, you will come out ahead in the end. Please ensure that you understand the spirit and the letter of these rules before beginning any class work.
6. You are encouraged to work together on problem sets, especially those designated as group work. However, unless the problem set is specifically designated as group work, you must ultimately demonstrate your understanding of the material by writing up your own solutions without the help of other students or their written work. If you consult with other students (or faculty) on a problem set, this should be considered equivalent to consulting any other reference and should be cited appropriately. This policy will be strictly enforced.
7. All assignments should be submitted electronically by e–mailing a file to the instructor by the beginning of the class period in which the assignment is due. The official turn–in time of the assignment will be the time stamp on the e–mail.
8. Higher learning involves not just acquiring knowledge, but developing the ability to know what you don't know. Among other things, this involves the ability to know when you do and do not have a rigorous proof or an accurate answer. One of the goals of this course is to cultivate your ability to perform an accurate self-assessment of your work. Hence, you are encouraged to think about and state accurately not only the parts that you do understand from each homework, but also the parts that you do not. Please do not muddle your way through proofs and other exercises in the hope that I will not read them carefully. You will get additional credit for an accurate self-assessment of your answer or approach. If you have gotten most of the way through a proof and just cannot complete the last step or even if you are missing a step in the middle but know how to do the rest, just try to write down what you have done so far and what it is that you don't know how to do. This will help me to better gauge where your understanding is incomplete so that we can review these areas in class. It will also demonstrate your understanding of your own work.
9. Effective learning also involves knowing where to go to get help when you realize that your knowledge or understanding of a topic is incomplete. This could mean consulting external references or coming to office hours. It can also mean asking a question in class when you don't understand part of the lecture.
10. I very much appreciate and enjoy getting as much feedback from my students as possible, even if it is not all positive. Please don't be afraid to tell me what you think. If you want to just stop by to chat, feel free. My door is usually open, but if you could utilize office hours as much as possible, I would appreciate it. If you would like to make an appointment outside office hours, just call or send an e-mail.

ASSESSMENT INSTRUMENTS

Allocation of Marks

Assessment Instruments	Mark	Expected Appointment		
		Date	Day	Time
First Examination	15	08.07.10	Thursday	08:00 – 09:00
Second Examination	15	01.08.10	Sunday	08:00 – 09:00
Quizzes	20	2 quizzes (see course calendar below)		
Final Examination	50	15.08.10 – 18.08.10		
Total	100			

COURSE ACADEMIC CALENDAR

Class	Date	Topic
01	20/06/2010	**Chapter One: Introduction.** 1. Strategy of Experimentation. 2. Some Typical Applications of Experimental Design.
02	21/06/2010	3. Basic Principles. 4. Guidelines for Designing Experiments.
03	22/06/2010	• Supplemental Text Material for Chapter One.

04	23/06/2010	**Chapter Two: Simple Comparative Experiments.** 1. Introduction. 2. Basic Statistical Concepts.
05	24/06/2010	3. Sampling and Sampling Distributions.
06	27/06/2010	4. Inferences about the Differences in Means, Randomized Designs. a. Hypothesis Testing. b. Choice of Sample Size. c. Confidence Intervals.
07	28/06/2010	d. The Case Where $\sigma_1^2 \neq \sigma_2^2$. e. The Case Where σ_1^2 and σ_2^2 are Known. f. Comparing a Single Mean to a Specified Value.
08	29/06/2010	5. Inferences about the Differences in Means, Paired Comparison Design. a. The Paired Comparison Problem. b. Advantages of the Paired Comparison Design.
09	30/06/2010	c. Inferences about the Variances of Normal Distributions. • Supplemental Text Material for Chapter Two.
10	01/07/2010	• *Quiz No. 1.*
11	04/07/2010	**Chapter Three: Experiments with a Single Factor: The Analysis of Variance.** 1. An Example. 2. The Analysis of Variance.
12	05/07/2010	3. Analysis of Fixed Effects Model. a. Decomposition of the Total Sum of Squares. b. Statistical Analysis.
13	06/07/2010	c. Estimation of the Model Parameters. d. Unbalanced Data.
14	07/07/2010	4. Sample Computer Output. • Supplemental Text Material for Chapter Three.
15	08/07/2010	*First Examination*
16	11/07/2010	**Chapter Four: Randomized Blocks, Latin Squares, and Related Designs.** 1. The Randomized Complete Block Design. a. Statistical Analysis of the RCBD. b. Model Adequacy Checking.
17	12/07/2010	c. Some Other Aspects of the RCBD. d. Estimation Model Parameters & the General Regression Significance Test.
18	13/07/2010	2. The Latin Square Design.
19	14/07/2010	3. The Graeco–Latin Square Design.
20	15/07/2010	4. Balanced Incomplete Block Designs. a. Statistical Analysis of the BIBD. b. Least Squares Estimation of the Parameters.
21	18/07/2010	• Supplemental Text Material for Chapter Four. • *Quiz No. 2.*
22	19/07/2010	**Chapter Five: Introduction to Factorial Design.** 1. Basic Definitions and Principles. 2. The Advantage of Factorials.
23	20/07/2010	3. The Two–Factor Design a. An Example. b. Statistical Analysis of the Fixed Effects Model.
24	21/07/2010	c. Estimating the Model Parameters. d. Choice of Sample Size.
25	22/07/2010	e. The Assumption of NO Interaction in a Two–Factor Model.
26	25/07/2010	4. The General Factorial Design.
27	26/07/2010	5. Blocking in a Factorial Design. • Supplemental Text Material for Chapter Five.
28	27/07/2010	**Chapter Six: The 2^k Factorial Design.** 1. Introduction.
29	28/07/2010	2. The 2^2 Design.
30	29/07/2010	3. The 2^3 Design.
31	01/08/2010	*Second Examination*
32	02/08/2010	4. The General 2^k Design.
33	03/08/2010	5. A Single Replicate of the 2^k Design.
34	04/08/2010	6. 2^k Designs are Optimal Designs.
35	05/08/2010	7. The Addition of Center Points to the 2^k Design.

		• Supplemental Text Material for Chapter Six.
36	08/08/2010	**Chapter Seven: Blocking and Confounding in the 2^k Factorial Design.** 1. Introduction. 2. Blocking a Replicated 2^k Factorial Design.
37	09/08/2010	3. Confounding in the 2^k Factorial Design.
38	10/08/2010	4. Confounding the 2^k Factorial Design in Two Blocks. 5. Confounding the 2^k Factorial Design in Four Blocks.
39	11/08/2010	6. Confounding the 2^k Factorial Design in 2^p Blocks.
40	12/08/2010	7. Partial Confounding. • Supplemental Text Material for Chapter Seven.
41	15-18/08/10	Final Examination

EXPECTED WORKLOAD:

On average students need to spend, at least, 9 hours of study and preparation per week for this course.

ATTENDANCE POLICY:

Absence from lectures shall not exceed 15 .%Students who exceed the 15 %limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course .If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.