

# EMA 6808 - Error Analysis and Optimization Methodologies in Materials Research

Spring, 2015

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**Lecture:** MWF, 3:00-3:50, NEB 201

**Class Website:** E-Learning (Sakai)  
Log on: <https://elearning2.courses.ufl.edu/portal>

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**Instructor:** Henry Sodano  
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**Office Hours:** Monday and Wednesday 4:00-5:00; or by appointment (e-mail)

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**Text:** D. Montgomery, Design and Analysis of Experiments, 8th edition, Wiley, (2012)  
ISBN-13: 978-1118146927

## Recommended Reading:

P.F. Dunn, Measurement and Analysis for Engineering and Science, CRC, (2010)  
Introduction to Engineering Experimentation, by Anthony J. Wheeler; Ahmad R. Ganji, Princeton Hall. ISBN 978-0-13-174276-5

Supplementary reading and links to various other websites may be provided and updated throughout the semester.

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## Course Description:

Statistical approach for materials research, basic and relevant statistical concepts, error analyses, factorial matrices, reducing the variance, nested designs and sampling plans, mixture designs, optimization technology, response surface method.

## 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. The techniques to acquire data and basic tools required for instrumentation, reduction of noise and sampling. The concept of uncertainty in measurements and the propagation of error through measurements will be highlighted. The expectation of this course is that you will learn the techniques required to make measurements, analyze the data and determine the error. Statistical analysis will be used to determine error and probability. Lastly the course will cover experimental design and the analysis of variance to determine if a measurement is statistically relevant in the presence of many variables.

Opportunities to use the principles taught in the course arise in all phases of engineering work, including new product design and development, process development, and manufacturing process improvement. Applications from various fields of engineering (including chemical, mechanical, electrical, materials science, industrial, etc.) will be illustrated throughout the course. Computer software packages (Design-Expert, Minitab) to implement the methods presented will be illustrated extensively, and you will have opportunities to use it for homework assignments and the term project.

The course will involve Error Analysis, Statistical Design of Experiments, Comparing Two or More Treatments, The Balanced Block Design, Factorial Designs, Lab & Industrial Applications, Fractional Factorials, Screening Techniques, Least Square Theory, Regression Analysis, Optimization Techniques and Surface Responses. The course will also cover experimentation, measurement techniques, data acquisition, filtering, sampling, noise, error and uncertainty.

## Topics:

1. Introduction to measurements (1 week)
2. Electronics and Circuits (1 weeks)
3. Measurement Systems and Data Acquisition (3 weeks)
4. Statistical Analysis of Measurements (2 weeks)
5. Uncertainty Analysis (2 weeks)
6. Regression and Correlation (2 weeks)
7. Design of Experiments (3 week)

## Homework & Exams

- Homework assignments are due on at the beginning of class.
- Collaboration on homework problems is encouraged, but each person should submit his/her own work. The use of a solution manual to assist in the completion of your homework is considered cheating and will be punished with a zero for all course homework.
- Homework must be submitted on engineering paper.
- Late homework is penalized 10% per weekday until solutions are web-posted.
- Exams will be held during normal class times and will be based on class notes, reading, and especially homework. You may use one side of a single 8.5" × 11" piece of paper for equations during the tests. You may only have equations on this page and it must be submitted with the exam.

## Final Project:

EMA 6808 will require a final project to be completed as the final exam. The final project will be due on the first reading day before finals. Additional information regarding the final project will be provided at a later date.

## Attendance and Expectations:

All students are expected to attend class. Attendance also requires participation in class by solving problems in small groups and presenting the solutions in front of the class. Cell phones should be turned off. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during class time.

## Grading

Exam 1:	25%	February 20th
Exam 2:	25%	April 17th
Final Project:	35%	April 23rd
Homework:	15%	TBD

## Computer Use

It is the formal policy of this class that some use of computers is necessary. This includes access to and the use of the Internet. Additional requirements are the use of Matlab or equivalent.

## Class attendance

Attendance to lectures is expected. If you must miss lecture for any reason, you should obtain the lecture notes from another student.

## Other behavior expectations

Students are expected to take a sincere interest in learning the classroom material. Keeping with this expectation, students should: 1) not create distractions (i.e. turn cell phones off); and 2) show up to class on time; and 3) be courteous to other students and the instructor.

## Collaboration

As mentioned previously, collaboration on homework problems is encouraged. However, each person must submit his/her own work. A refined description of what is allowed is listed below:

- Copying homework is a violation of the Honor Code. In particular, showing other students a copy of the actual manuscript to be submitted as homework is not allowed and is subject to the strictest disciplinary sanctions.
- Copying the solution manual is strictly prohibited.
- Students are free to consult among themselves on the approach taken to solve any given homework problem as long as the above provision is not violated. Acceptable consultation includes discussing which equations in the textbook should be used for solving a problem, as well as writing down relevant relationships, etc.

### **Make-up Exam Policy**

No make-up exams will be given. Students who do not attend an exam session at the scheduled time will receive a score of zero points in that exam.

Exceptions will be made only in extraordinary circumstances. In such cases students may receive only partial credit in a make-up exam. Full credit is reserved only for regularly scheduled exams.

### **Accommodations for Disabilities**

Students with disabilities who are requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodations.

### **Academic Honesty**

As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all of their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.

### **Grading Scale**

All UF course syllabi must contain information on current UF grading policies for assigning grade points. Information regarding letter grades and associated grade points may be found at: <http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html> An example numerical grading scheme is shown below. This information should only be used as a general guide as the course instructor reserves the right to adjust the final numerical grading demarcations. The final grade demarcations will not be higher than shown:

A = 93-100	A- = 90-93	B+ = 87-90	B = 83-87	B- = 80-83	C+ = 77-80	C = 73-77
C- = 70-73	D+ = 67-70	D = 63-67	D- = 60-63	E = <60 (failing grade)		

Questions regarding grades must be brought to your lab instructor within two weeks after return of the paper to the class. A typed note explaining your concern/issue must be stapled to the front of the paper when it is brought for reconsideration.

### **Software Use**

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.