

Error Analyses and Optimization Methodologies in Materials Research

EMA 3800 Section 5307

Class Periods: MWF, Period 2, 8:30a – 9:20a

Location: Online

Academic Term: Spring 2021

Instructor:

Victoria M Miller (she/her/hers)

victoria.miller@ufl.edu (but please contact through Piazza for questions related to course content)

Office Hours: TBD by class poll, will be posted on Canvas

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through Piazza

- Benjamin Anthony, benjamin.anthony@ufl.edu
Office Hours: TBD by class poll, will be posted on Canvas

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 and Taguchi.

Course Pre-Requisites / Co-Requisites

Corequisite: EMA3010

Course Objectives

Students will develop fluency with multiple methods of statistical analysis and experimental design.

Students will become comfortable with data methods in materials science: designing experiments to generate data, using code to manipulate and perform statistical tests on data, and using data to draw valid conclusions about a scientific question.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Low
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

- Design and Analysis of Experiments
- Douglas C. Montgomery
- 7th Edition, Wiley (Other recent editions are also acceptable.)
- 9780470169

Recommended Materials

- An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements
- John R. Taylor
- 2nd edition, 1996
- 093570275X

Important Dates

- Week of Feb. 22: Take home midterm (exact date flexible)
- Week of Mar. 1: No lectures or homework to allow work on labs and project

Course Schedule

The course schedule is subject to change, but will be kept up to date on Canvas. The following topics will be covered:

- Basic coding (2 weeks)(Instructor Notes)
 - Includes introduction to linear algebra
 - Includes file I/O and data manipulation
 - Includes data plotting
- Scientific method (Approx 1 lecture) (Instructor Notes)
- Basic statistics (3 weeks)(Chapter 2)
- ANOVA (2 weeks)(Chapter 3)
- Design of Experiments with several factors (2.5 weeks)(Pulling from several chapters, specific book sections listed on Canvas)
- Fitting data to models: classic methods (1.5 weeks)(Chapter 10)
- Querying databases and introduction to machine learning (2 weeks)(Instructor notes and nanoHUB)
- Statistical software, e.g. JMP (1 week)(Instructor notes)

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

- Piazza
 - This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to me or the TA, please post your questions on Piazza.
 - Piazza can be accessed through Canvas or directly: <https://piazza.com/ufl/spring2021/ema3800/home>
- Homework
 - Homework will be assigned approximately weekly.
 - Late assignments will be accepted until homework solutions are posted. Students will lose 10% of the total points each day or portion thereof that the assignment is late.
- Attendance and Absences
 - You are not required to attend the synchronous class sessions EXCEPT THE FIRST ONE. Please come to the first class period so we can schedule office hours and handle other logistical stuff.
 - “Lectures” will be posted online, and the synchronous class periods will be used to work problems, go over homework and exam solutions, go through quiz solutions, etc. The synchronous problem sessions will also be recorded. It is mandatory to watch the lectures, but it is not mandatory to watch the problem sessions.
 - If you are sick (with covid or anything else) please let me know! I can work with you if I know, but I’m not psychic.
 - Verification of an absence may be required in extreme circumstances, e.g. missing a midterm exam. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.
- “Quizzes”
 - Unannounced quizzes (approx. 10 minutes duration) will be posted periodically. They will be primarily graded for completion, and I will go over the answers in class.
 - The lowest quiz grade will be dropped.
 - The quiz will open at the conclusion of one lecture, requiring a password from that lecture. It will close at the start of the next lecture.
 - Students can make up quizzes for 50% credit within 1 week of the original quiz date, no questions asked.
 - The quizzes are meant to both force you to keep current with the lectures and to show me what concepts the class is struggling with.
- Extra Credit
 - Students that make a useful demo that I can use in class will receive up to five extra credit points (based on demo quality) to be assigned to the lowest homework grade. “Standard” projects will receive 3 points, with additional points awarded for exceptional work. In order to receive credit, student must provide a typed description of the class concept being demonstrated (minimum of a half page single spaced). Within reason, there is no maximum number of demos a student can submit. Extra credit will be accepted until the last day of classes. A maximum of one demo per week per student will be accepted.
 - Additional opportunities for extra credit may be announced during lecture.
- Be Nice!
 - Incivility toward students, staff, or faculty will not be tolerated.
 - If you'd like me to call you by a different name, different pronouns, etc. just let me know!

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework Sets (equally weighted)	40%
Quizzes (each equally weighted)	15%
Midterm Exam	15%
Final Exam	15%
Project	15%
	100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students 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.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.