

**Course Syllabus**  
**Nancy Ruzycki**  
**EMA 3800 Error Analysis and Optimization Methods**  
**Spring 2016**

1. Catalog Description (3 credits): 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.
2. Pre-requisites and Co-requisites:  
EMA3010
3. Course Objectives: Students will develop a skill set to apply statistical approaches for materials research.
4. Contribution of course to meeting the professional component: This is a 3 credit course.
5. Relationship of course to program outcomes: This course addresses the following MSE Program outcomes (note: Numbers refer to the list of MSE Program outcomes):
  1. B2 Ability to conduct experiments, analyze and interpret data. For this course, the students will have to follow instructions, set-up experiments, collect data and interpret data, and discover any sources of error. (HIGH)
  2. C Ability to conduct and analyze design of experiments (DOE). The students will be exposed to a simple experiment, identify the control variables, the uncontrolled variables and asked to expose sources of error and solutions to those sources. (HIGH)
6. Instructor: Dr. Nancy Ruzycki
  - a. Office location: RHN 135
  - b. Telephone: 352.846.2991
  - c. E-mail address: nruzycki@mse.ufl.edu
  - d. Office hours: W 5<sup>th</sup> F 5<sup>th</sup> (or by appointment)
7. Teaching Assistant: none
8. Meeting Times: MWF 3rd period FAC 120 (Fine Arts C- located on inner road almost to 13<sup>th</sup> street)
9. Class/laboratory schedule: lecture three times a week for one hour
10. Meeting Location: Lecture – FAC 120
11. Materials and Supply Fees: none
12. Textbooks and Software: **Required textbook** is “An Introduction to Error Analysis”, John R Taylor, 2<sup>nd</sup> Edition, 1997, University Science Books, ISBN 13:978 -0-935702-75-0.  
Second half of semester: “A First Course in Design and Analysis of Experiments”, Gary W. Oehlert, 1<sup>st</sup> Edition, 2000, W. H. Freeman, ISBN: 0716735105  
(free download (Creative Commons License - <http://users.stat.umn.edu/~gary/book/fcdae.pdf>))  
  
Required software will be MATLAB. MATLAB is available to students through the student computing cloud.
13. **Recommended Reading:** “Getting Started with MATLAB”, Ruda Pratap, 2010, Oxford University Press, ISBN: 978-0-19-973124-4  
  
Downey, Allen, "Think Bayes" (2013). 2013. Paper 11.  
[http://digitalcommons.olin.edu/facpub\\_2013/11](http://digitalcommons.olin.edu/facpub_2013/11)  
<http://www.greenteapress.com/thinkbayes/thinkbayes.pdf>

14. Course Outline - Below is the tentative schedule of topics, activities, reading assignments, exams, and homework. See Sakai for Chapter and Unit Objectives, Learning Outcomes, assignments, and rubrics. This outline is subject to change.

Topic	Student Product	weeks
Why do we care about error analysis? Uncertainty in measurement. Propagation of uncertainty. Statistical analysis of uncertainty, Normal Distribution. Getting started with MatLAB or SciLab.	Statistics Concept Inventory Homework Taylor (individual) Student in class activities on measurement and error analysis (group) MATLAB programs on error analysis (group and individual) In class formative assessments	2
Rejection of Data Weighted averages Least Squares Fitting Covariance and correlation Poisson Distribution Chi-Squared Test for Distribution Unusual data sets (soft matter)	Homework Taylor (individual) Student in class activities using experimental data (group) MATLAB programs (group and individual) In class formative assessments In class Summative Assessment (EXAM)	3
Decision Analysis Bayesian Analysis	Student in class activities using experimental data (group) In class formative assessments Student decision making projects	1
Design and Analysis of Experiments Randomization and design Completely randomized design Contrasts Multiple comparisons Checking assumptions Power and Sample size Data Cleaning Tests of significance How your research questions determines statistical analysis (what test to use when) Taguchi	Homework Oehlert (individual) Student in class activities using Oehlert text, and experimental data for data cleaning (group) MatLAB data cleaning exercise. In Class Summative Assessment (EXAM)	3
Student projects in error analysis and experimental design related to a specific departmental focus area.	Student Analysis of Experimental Design Group Analysis of experimental design and data Student and group experimental design proposal/peer review Student research presentations Paper on student research project (group) Concept inventory (post) In class final Summative Assessment (EXAM)	3

Each Topic will have a student product which will be graded as a formal assessment. There will be a rubric for each product. Student products may include, but are not limited to; lab reports, posters, abstracts, research proposals, users manuals, program codes, technical letters, oral presentations.

15. Attendance and Expectations - Attendance is **strongly** suggested since significant amount of participative as well as individual and collaborative work will be performed during the class sessions and will be worth as greater than 20% of the course points. **Students are expected to comply with all laboratory guidelines, protocols, and procedures. Students who do not comply with these requirements, or who behave disorderly or disrespectfully WILL be asked to leave. Leaving your cell phone on, leaving early or arriving late can be VERY distracting, you should avoid it. All electronic devices (laptops, cell-phones, etc.) should be turned off or in silent mode.** Use of smartphones, laptops, tablets or similar personal computers is not allowed unless explicitly requested by the individual student the first day of class and for note taking purposes only. No audio/video recording is allowed with express permission of lecturer.

Students will be grading according to the following:

Student Products(homework, programs, projects)	70% of final grade
Student informal and formal assessments (pre-labs, lab quizzes, surveys, exit tickets, quick writes, in class exercises)	20% of final grade
Final Exam	10 % of final grade

16. **Final EXAM is a cumulative exam. The final Exam period is 27A. 7:30 a.m. - 9:30 a.m.**

17. Grading Scale - Grades will not be curved and there is no extra credit.

Grade Earned percentiles total

A 93  
A- 88  
B+ 84  
B 80  
B- 76  
C+ 72  
C 68  
C- 65  
D+ 62  
D 59  
D- 56  
E 50

This statement must be included in every grade scale for undergraduate level 1000-5000 syllabi:

“A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

18. Make-up Exam Policy – Make up exams will be provided only with the **prior approval of the instructor in accordance with university policies**. In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, and religious holidays. In all cases you will be required to provide written documentation, and obtain prior instructor approval. You will not be excused from any exam without following the policy above, with no exceptions. Students not in attendance for the scheduled exam will receive a score of zero. To be clear, Make-up exams will only be allowed in exceptional cases, with prior instructor approval, sufficient documentation, and in accordance of university policies. Make-up exams for excused absences as well as exam conflicts must occur within 1 week of the missed exam, and may occur before the missed exam. Unexcused missed lecture class formative assessments may not be made up.

19. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. 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.