EMA3800 Error Analysis and Optimization of Experiments
Standardized Syllabus for the College of Engineering

1. Catalog Description (3) – 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: Pre-requisite/Co-requisite EMA 3010
3. Course Objectives – Students will develop fluency with multiple methods of statistical analysis and experimental design.
4. Contribution of course to meeting the professional component. This is a 3 credit course. It provided 3 credits towards engineering sciences.
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. Apply knowledge of mathematics, science and engineering principles to materials science and engineering.
    2. Design and conduct materials science and engineering experiments and analyze and interpret the data.
    3. Design a materials science and engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.
    4. Communicate technical data and design information effectively in speech and in writing to other materials engineers.

    This course addresses the following ABET criteria

    >(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.

    >(c) Ability to apply and integrate knowledge of structure, properties, processing, and performance to solve materials selection and design problems within realistic constraints.

5. Instructor: Dr. Nancy Ruzycki, Dr. Shema Freeman

6. Office location: RHN 135
7. Telephone: 352.846.2991
8. E-mail address: nruzycki@mse.ufl.edu
9. Office hours: TDB day one *probably Wednesdays or Tuesdays or by appointment
10. Teaching Assistants: TBD
11. Class meeting times –M, W, F 2nd period MAEB211
12. Class/laboratory schedule: lecture three times per week for one hour, laboratory once a week for two hours.
13. Materials and Supply Fees: N/A

14. Textbooks and Software Required: Required Reading: Title; "Statistics and Analysis of Scientific Data", Massimiliano Bonamente, 2nd Ed., 2017, Springer, ISBN:978-1-4939-6570-0

    Recommended Reading :Title:"An Introduction to Error Analysis", John R Taylor, 2nd 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, 1st Edition, 2000, W. H. Freeman, IBSN: 0716735105

    Recommended Software MATLAB

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

    There may be changes/substitutions to the laboratories listed below, depending upon available equipment, and student progress.

    Students are expected to dress properly for laboratory class. Closed toed shoes are required for class. Pants are preferred. There is no food or drink of any kind in the laboratory. See laboratory safety guidelines for more information.

    16.

Topic	Student Product	weeks
Basic probability Bayes Theorem	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	1-2
	Statistics Concept Inventory Homework (individual)	3-4

	Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	
Three Fundamental Distributions	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	5-6
Random Variables and Error Propagation	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	7-8
Maximum Likelihood Average values of variables Hypothesis Testing and Stats	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group)	9-10

	MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	
Mutivariable Regression and Goodness of fit	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam)	11
Anova and Model Comparison	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group) MATLAB programs (group/class and individual) In class formative assessments In class summative assessment (Exam) Start student projects	12
Advanced topics	Statistics Concept Inventory Homework (individual) Student in class activities on measurement and error analysis (group)	12-16

	MATLAB programs (group/class and individual) In class formative assessments Final summative assessment (Exam) Student project presentations	

17. **Writing Requirement.** Each Topic listed above 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.

There is no writing credit for the class, but student writing will be graded using the UF writing rubric in addition to the class rubrix

All written assignments <u>must</u> be turned in early to receive feedback on the draft version, if you want early feedback. These dates will appear on the course website and will be approximately 1 week before main assignment due date. All writing assignments will be turned in through the class web portal and will be subjected to anti-plagiarism detection. Students found to have plagiarized will be subject to university policies.

Below is the UF writing rubric which will be used to judge mechanics and flow of the written student product. Each student product will also carry a content based rubric. The student products carry two grades, one for the writing mechanics, and one for the content mechanics. Students must satisfactorily meet both rubrics for a passing assignment.

	SATISFACTORY (Y)	UNSATISFACTORY (N)
CONTENT	Papers exhibit at least some evidence of ideas that respond to the topic with complexity, critically evaluating and synthesizing sources, and provide at least an adequate discussion with basic understanding of sources.	Papers either include a central idea(s) that is unclear or off- topic or provide only minimal or inadequate discussion of ideas. Papers may also lack sufficient or appropriate sources.
ORGANIZATION AND COHERENCE	Documents and paragraphs exhibit at least some identifiable structure for topics, including a clear thesis statement but may require readers to work to follow progression of ideas.	Documents and paragraphs lack clearly identifiable organization, may lack any coherent sense of logic in associating and organizing ideas, and may also lack

		transitions and coherence to guide the reader.
ARGUMENT AND SUPPORT	Documents use persuasive and confident presentation of ideas, strongly supported with evidence. At the weak end of the Satisfactory range, documents may provide only generalized discussion of ideas or may provide adequate discussion but rely on weak support for arguments.	Documents make only weak generalizations, providing little or no support, as in summaries or narratives that fail to provide critical analysis.
STYLE	Documents use a writing style with word choice appropriate to the context, genre, and discipline. Sentences should display complexity and logical sentence structure. At a minimum, documents will display a less precise use of vocabulary and an uneven use of sentence structure or a writing style that occasionally veers away from word choice or tone appropriate to the context, genre, and discipline.	Documents rely on word usage that is inappropriate for the context, genre, or discipline. Sentences may be overly long or short with awkward construction. Documents may also use words incorrectly.
MECHANICS	Papers will feature correct or error-free presentation of ideas. At the weak end of the Satisfactory range, papers may contain some spelling, punctuation, or grammatical errors that remain unobtrusive so they do not muddy the paper's argument or points.	Papers contain so many mechanical or grammatical errors that they impede the reader's understanding or severely undermine the writer's credibility.

18. Attendance and Expectations - Attendance is **strongly** suggested since significant amount of participation, as well as individual and collaborative work will be performed during the class sessions and will be worth as much as 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**. If your cellphone rings during class it will be confiscated for the remainder of the class period. 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 without express permission of lecturer.

19. Grading: Students will be graded 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

The Final Exam is a cumulative exam. The exam period is 3E.

20. Grading Scale - Grades will not be curved.

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

"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 (Links to an external site.)Links to an external site.

21. Make-up Exam Policy – Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx (Links to an external site.)Links to an external site.
22. 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.
23. 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.
24. 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.

25. 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 higher standard.

26. Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at [https://evaluations.ufl.edu (Links to an external site.)Links to an external site.](https://evaluations.ufl.edu). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at [https://evaluations.ufl.edu (Links to an external site.)Links to an external site.](https://evaluations.ufl.edu).

27. Diversity and Inclusion: This course supports diversity and inclusion for all students. Effective engineering practice relies on the ability to recognize and embrace diversity in all its forms, including viewpoints.