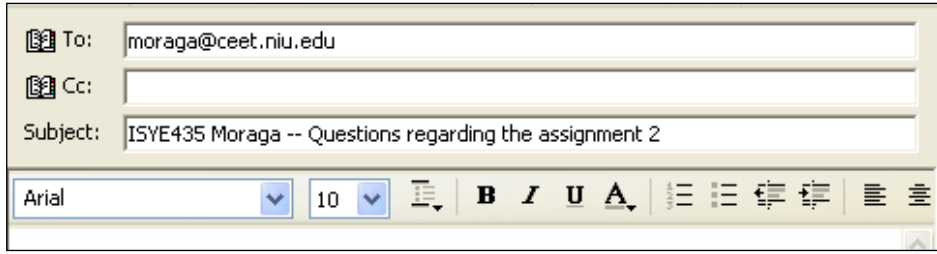# ISYE435-535 Experimental Design for Engineers
Course Syllabus
3 Semester Hours (3,0)

FACULTY	Dr. Reinaldo J. Moraga Phone (815) 753 8048	Office EB #126 e-mail: rmoraga@niu.edu
OFFICE HOURS	I look forward to meeting and getting to know you all, and will hold office hours on Wednesday 9.30-10.30am. <u>Any time that you desire to meet with me outside of normal office hours you are advised to schedule an appointment at a mutually agreeable time.</u> I will also be glad to talk with you before or after classes as time permits. E-mail is the best and most reliable method through which you can reach me.	
MEETING DAY, TIME, AND LOCATION	Monday & Wednesday 08.00-09.15am. EB Room# 358 (TBA)	
TEACHING ASSISTANT	TBA	
CATALOG DESCRIPTION	Statistical techniques for designing and analyzing relationships among variables in engineering processes. Engineering applications of analysis of variance (ANOVA), factorial design, and fractional factorial design.	
REQUIRED TEXTS	Montgomery, D.C., *Design and Analysis of Experiments*, Tenth Edition, Wiley and Sons, 2020.	
SUPPLEMENTAL TEXTS, HELPFUL WEBSITES, AND OTHER MATERIALS	TBA	
LIBRARY RESOURCES	Online journal databases can be found at http://www.ulib.niu.edu/ Also you may access some library services at http://www.ulib.niu.edu/#Services	
CONTACT PROCEDURES FOR CLASS: BLACKBOARD	Blackboard is the communication tool used in this class. All class-related materials are posted there. Blackboard is a software package that enhances communication among students and between students and instructor. The idea is to make course-related communication better. To access: Launch Chrome or Firefox, go to http://webcourses.niu.edu/. For help go to password.niu.edu. Or call 815-752-7738 (815-752-RSET)	
COURSE PREREQUISITES; INSTRUCTOR EXPECTATIONS OF CERTAIN STUDENT ABILITIES	**PR: *ISYE335* or consent of department.** Students are expected to use MS Office (Word and Excel) at professional level.	
GENERAL INFORMATION AND EXPECTATIONS	Topics are given on the attached course outline. Each student is responsible for keeping current with all assigned course material and for resolving any area of misunderstanding. Students are expected to read text material prior to class meetings and to be prepared to discuss assigned topics in class.	
MAIN LEARNING OBJECTIVES	The course aims: a) To give students an introduction to the field of experimental design. b) To have students collect data from experiments. c) To analyze results of experiments using experimental design techniques and software tools acquired from this course. d) To allow students to design, perform and analyze an experimental design project. e) To expose students to advanced applications of experimental design (*i.e.*, process optimization and improvement)	

DEPARTMENT EDUCATIONAL OBJECTIVES	1. Provide students with the knowledge, skills, and tools to model people-technology systems using the techniques of mathematics, science, and engineering. 2. To design potential solutions to problems and evaluate the consequences of their solutions in the broader context of the organization, society, and the environment. 3. To communicate effectively the benefits of their proposed solutions using written, oral, and electronic media. 4. To function effectively and provide leadership within an organization as a professional and ethical member of society, including the ability to facilitate and participate in multi-disciplinary teams. 5. To initiate and complete self-directed learning for professional and personal development especially with respect to contemporary issues.	

COURSE CONTRIBUTION TO PROGRAM OUTCOME		Program Outcomes	Relation-ship
	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. 2.3 Applies analytics tools, software, creativity, and "outside-of-the-box thinking" to generate solutions.	4
	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. 5.3. Develop and follow a project plan with milestones to achieve project goals.	4

	6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
		    6.1 Defines a problem statement, dependent/independent variables and/or appropriate hypothesis.
		    6.2 Uses and documents measurement techniques to collect data.
		    6.3 Applies appropriate tools and techniques to analyze data.
			4

	Relationship Rating: 4 = very strong relationship, 3 = strong relationship, 2 = some relationship, 1 = weak relationship, 0 = no relationship		

COURSE CONTRIBUTION TO GRADUATE PROGRAM OUTCOME		Program Outcomes	Relation-ship
	a	An ability to define and formulate Industrial and Systems Engineering problems.	4
	b	An ability to apply math and scientific tools to define, design, predict, improve, and optimize the systems performance.	4
	c	An ability to independently learn advanced topics in Industrial and Systems Engineering	2
	d	An Ability to conduct research or project professionally and ethically	2
	e	An ability to effectively communicate ideas/concepts and research findings through technical reports and professional presentations	2
	Relationship Rating: 4 = very strong relationship, 3 = strong relationship, 2 = some relationship, 1 = weak relationship, 0 = no relationship		

CATEGORIES OF ASSESSMENT	Group project (report + presentation) – 30% (Peer evaluation required) Group/Individual assignments (6) – 25%† Comprehensive Tests (3) – 45%‡ ——————————————————— Total 100% Class participation (including feedback) −05 points Please note that each team member's grade for group projects and homework will be determined based on a factor calculated from individual evaluations submitted by all group members. **Peer evaluations (PE) are mandatory for group works and failing to submit them may put your group in lateness status.** (†) For Graduate students one of these assignments is based on research. (‡) For Graduate students advanced questions will be given in quizzes and the exam. **Note: After each graded examination or assignment is returned, you will have 24 hours to let me know in written of any disagreement regarding the grading procedure.**

PEER EVALUATIONS	Unless contrary stated by the instructor, each group assignment, project, or examination will be peer evaluated. Teamwork's individual grades (G_j) are determined based on a factor (f_j) calculated out of peer evaluations. This is how it works:
	
	$$G_j = \min(f_j G, 100), \text{ with } f_j = \frac{\overline{x}_{.j}}{\overline{x}}$$
	
	Where,
	  G_j is the individual grade obtained by the student.
	  f_j is the factor that measures the student's (j) relative performance in the group with respect to all others.
	  G is the grade given to the group assignment by the instructor.
	  $\overline{x}_{.j}$ is the average evaluation peers provide to student j.
	  $\overline{x}$ is the overall average evaluation of the team out of peer evaluations.
	
	In order to obtain $\overline{x}_{.j}$, students consider and provide justification on the following criteria (1-100):
	• **Level of Participation**: related to evaluate how active your partners were to get the job done, i.e. did he/she show up to all scheduled live/online meetings (or just to put his/her name on the report?)
	• **Quality of Work Assigned**: related to evaluate how well tasks were done by your partners, i.e. did you have to re-do anything? How about meeting due dates scheduled by the group?
	• **Level of Communication**: related to evaluate each member according to his/her communication, i.e. were your partners prompted to answer back emails, phone calls, etc.? Did he/she miss any scheduled meeting without let everybody else know?
	Peer evaluations are kept confidential, but individual students receive feedback. I also emphasize that when f_j<1 indicates that individual performance is being evaluated poorly by the members of the group. So, students should look for having a factor $f_j \geq 1$.

CLASS PARTICIPATION	Class discussions are to be regarded as an open forum in which everyone is expected to participate. I expect good preparation for each class, <u>prompt arrival before each class session begins</u>, and attentiveness to other students' comments. However, class participation also includes: posting or responding to messages on the Discussion Board (in case implemented), attending class, completing course activities on time, professional conduct in the classroom.
GRADE DISTRIBUTION	The grade you earn in this course will be a reflection of your overall effort and knowledge in regards to the material. I encourage you to discuss your grade situation with me as the course progresses. Do not wait until the end of the semester. Please note, however, that no changes will be made in grades at the end of the course unless a clerical error has been made. For undergraduate students:

For undergraduate students:

Percentage Grade	GRADE	GRADE POINT VALUE
95.1 – 100	A	4.00
90.1 – 95.0	A-	3.67
88.1 – 90.0	B+	3.33
84.1 – 88.0	B	3.00
80.1 – 84.0	B-	2.67
74.1 – 80.0	C+	2.33
68.1 – 74.0	C	2.00
56.1 – 68.0	D	1.00
01.0 – 56.0	F	0.00

For graduate students:

Percentage Grade	GRADE	GRADE POINT VALUE
96.1 – 100	A	4.00
92.1 – 96.0	A-	3.67
88.1 – 92.0	B+	3.33
85.1 – 88.0	B	3.00
82.1 – 85.0	B-	2.67
75.1 – 82.0	C+	2.33
68.1 – 75.0	C	2.00
56.1 – 68.0	D	1.00
01.0 – 56.0	F	0.00

GRADING ON A CURVE	This is not my practice.
INCOMPLETE GRADES POLICY	As a general rule, no Incomplete Grades are allowed in this course.
POLICY ABOUT DUE DATES	Each of the homework, projects, take-home examinations, group assignments, and peer assessments you will be completing in this class is due, unless otherwise stated by the instructor, by midnight of the deadline date. <u>Lateness may result in a penalization of 4 points per day or fraction thereof.</u> <u>It cannot go beyond graded assignments are returned or the solution is posted.</u> If whichever of these events happens, <u>the late assignment will result in a score of zero unless a documented excuse is provided at the time the assignment is due.</u>

POLICY ABOUT ABSENCES	Absences are not permitted on days we have quizzes or exams, unless a medical note can be emailed or faxed within 24 hours after the examination. The medical note must be sent by the medical office to the ISYE Department main office. In this class, only one medical justification will be accepted per semester. Special cases will be handled differently.
COMPUTER ACCESS AND ACCOUNTS	Computer use is intensive. Students have access to class software (**Minitab**, Excel, Design-Expert) in the Engineering labs.
COMPUTER FILES AND MESSAGES **NOTE: FAILING TO ABIDE BY THESE INSTRUCTIONS _MAY_ AFFECT YOUR GRADE!** (**-10** _POINTS_)	So that I can recognize email messages from you, I ask that you type "ISYE435 Your_LastName and brief_description" in the subject box of every email you send to me (or ISYE535 in the case of grad students); it's possible that I may not read your email message without this information! If you write correctly the class number in the subject, automatically an email will be sent back to you confirming reception of your message in my inbox folder. **Example:** ![Email example showing To: moraga@ceet.niu.edu, Cc: blank, Subject: ISYE435 Moraga -- Questions regarding the assignment 2] _Please, do not forget to put the class number in your emails!_ _Do not leave the description field in blank!_ Please be aware that I DO NOT open any file or e-mail that does not meet these instructions. I always acknowledge immediately all messages received, thus if you do not get a prompt answer within 24 hours, make sure that you sent the message according to these instructions. Otherwise, I would appreciate if you could send me a friendly reminder. ALL computer files e-mailed or submitted to the instructor MUST be named as follows: YourLastName (or GroupName) ABriefDescription.file type. **Example:** ![Word document icon] Moraga Final Article — Microsoft Word Document — 230 KB **_File names start with last name!_** Outlook intercepts and deletes files having extension .zip and .exe, without letting the sender or intended receiver know. I suggest you rename your file (example: whatever.zp or whatever.xe) and I will rename the extension after downloading the file.
GROUPS	Groups will be formed by students.
CLASSROOM ACCOMMODATIONS https://www.niu.edu/disability/accommodations/index.shtml	If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 or drc@niu.edu. Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

MENTAL HEALTH AND WELL-BEING STATEMENT	I understand that college students may experience a range of academic, social, and personal stressors, which can be overwhelming. You are not alone. Well-being at NIU offers resources, programs, and services. If you need assistance with comprehensive or crisis mental health support, Counseling and Consultation Services (CCS) at 815-753-1206 is ready to help.
ACADEMIC HONESTY **Please know your rights and obligations! Look into** Student Code of Conduct. https://www.niu.edu/conduct/process/index.shtml Read carefully **Article III on Prohibited Conduct Violations and Sanctions**.	**Exams and reports**: I expect to see your critical thinking! ***Avoid plagiarism*** (see definition in the Student Code of Conduct. ***Make sure you give appropriate credit to the ideas and materials from other persons***. **Exams, quizzes, and individual assignments**: **Unless stated in writing by the instructor, *all exams, quizzes and assignments are individual work.*** Students are not allowed to "share" flow-charts, programs, listings, or results. Note that for an experienced reviewer it is not difficult to detect "shared" logic! **Group assignments**. I expect each person to carry a fair share of the workload. **For each assignment, each person in a group will evaluate the contribution of his/her fellow team members.** These evaluations may change a person's grade by as much as a full letter grade (up or down) with respect to the team's grade. Please note that group members cannot exchange information about group assignments with members of other groups.
MY POLICY	**If cheating or plagiarism is detected, even straight A's in the rest of the class would allow you at best a C in the course.**
ACCOUTERMENTS (BOOK BAGS, SKATEBOARDS, COMPUTERS, CALCULATORS, ID'S)	Students are expected to behave in class as they would in a business meeting in industry. Sleeping, reading newspapers, holding private conversations and other similar behaviors are not acceptable in a business environment, nor are they acceptable in this class. You are not to make or receive any calls on your cell phone during class. Ringers should be turned to silent mode (or preferably your phone should be turned off). Do not check your phone during class for incoming calls or messages. This behavior not only is unacceptable in class, but also it damages the learning environment and makes hard for me to do my job.
SUPPLEMENTAL ATTACHMENTS/HAND-OUTS	- Detailed description of assignments - TBA - Examples of previous student work and explanation of your assessment – TBA

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COURSE OUTLINE
(Subject to Change)

Wk	*MONDAY*	*WEDNESDSAY*	Readings and Comments
Jan 12	Syllabus highlights Blackboard	Introduction Brief Statistic Review	Ch 1,2
Jan 19	Martin Luther King, Jr. Day - No classes.	Comparative Experiments	Ch 2
Jan 26	Comparative Experiments	Experiments with a Single Factor, Blocking	Ch 3
Feb 02	Experiments with a Single Factor, Blocking	Experiments with a Single Factor, Blocking	Ch 3
Feb 09	Randomized Blocks, Latin squares	Randomized Blocks, Latin squares	Ch 4
Feb 16	TEST 1	Introduction to Factorial Design	Ch 5
Feb 23	Introduction to Factorial Design	Introduction to Factorial Design	Ch 5
Mar 02	2^k Factorial Design	2^k Factorial Design	Ch 6
Mar 09	Spring Break	Spring Break	
Mar 16	2^k Factorial Design	2^k Factorial Design	Ch 6
Mar 23	Blocking and Confounding	Blocking and Confounding	Ch 7
Mar 30	TEST 2	Two-levels Factorial Designs	Ch 8
Apr 06	Two-levels Factorial Designs	Two-levels Factorial Designs	Ch 8
Apr 13	Two-levels Factorial Designs	Response Surface	
Apr 20	Response Surface	Project Presentations	Ch 11
Apr 27	Project Presentations		TEST 3 handed out
May 04	TEST 3 submissions		