General Education Course Submission Form Date of Submission: _____

1. Check which area(s) this course applies to.

Inquiry – Arts & Creativity	☐	Composition & Communications - II	☐
Inquiry – Humanities	☐	Quant Reasoning – Math	☐
Inquiry – Nat/Math/Phys Sci	☐	Quant Reasoning – Stat	X
Inquiry – Social Sciences	☐	Citizenship – USA	☐
Composition & Communications - I	☐	Citizenship - Global	☐

2. Provide Course and Department Information.

Department: Biosystems and Agricultural Engineering

Course Prefix and Number: BAE 202 Credit hours: 3

Course Title: Statistical Inferences for Biosystems Engineers

Expected Number of Students per Section: 40 Course Required for Majors in your Program? Yes

Prerequisite(s) for Course? MA 114

This request is for (check one): A New Course ☐ An Existing Course X

Departmental Contact Information

Name: Czarena Crofcheck Email: crofcheck@uky.edu

Office Address: 212 CE Barnhart Building Phone: 257-3000x212

3. In addition to this form, the following must be submitted for consideration:

- A syllabus that conforms to the Senate Syllabi Guidelines, including listing of the Course Template Student Learning Outcomes.
- A narrative (2-3 pages max) that explains: 1) how the course will address the General Education and Course Template Learning outcomes; and 2) a description of the type(s) of course assignment(s) that could be used for Gen Ed assessment.
- If applicable, a major course change form for revision of an existing course, or a new course form for a new course.

4. Signatures

Department Chair: _____ Date: 4-13-11

Dean: _____ Date: 4-13-11

College Deans: Submit all approved proposals electronically to:
Sharon Gill Sharon.Gill@uky.edu
Office of Undergraduate Education

Revised May 6, 2010

COURSE CHANGE FORM

Complete 1a – 1f & 2a – 2c. Fill out the remainder of the form as applicable for items being changed.

1. General Information.

a. Submitted by the College of: Engineering — Today's Date: 11-4-10

b. Department/Division: Biosystems and Agricultural Engineering

c. Is there a change in "ownership" of the course? YES ☐ NO ☒

If YES, what college/department will offer the course instead? _____

d. What type of change is being proposed? ☒ Major ☐ Minor[1] (place cursor here for minor change definition)

e. Contact Person Name: Czar Crofcheck — Email: crofcheck@uky.edu — Phone: 7-3000x212

f. Requested Effective Date: ☒ Semester Following Approval OR ☐ Specific Term[2]: _____

2. Designation and Description of Proposed Course.

a. **Current Prefix and Number:** BAE 202 — *Proposed Prefix & Number:* *BAE 202*

b. **Full Title:** Probability and Statisics for Biosystems Engineers — *Proposed Title:* *Statistical Inferences for Biosystems Engineering*

c. **Current Transcript Title** (if full title is more than 40 characters): _____

c. *Proposed Transcript Title (if full title is more than 40 characters):* *Stats Inferences Biosystems*

d. **Current Cross-listing:** ☒ N/A OR Currently[3] Cross-listed with (Prefix & Number): _____

Proposed – ☐ *ADD[3] Cross-listing (Prefix & Number):* _____

Proposed – ☐ *REMOVE[3, 4] Cross-listing (Prefix & Number):* _____

e. **Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[5] for each meeting pattern type.**

Current:	2 Lecture	2 Laboratory[5]	_____ Recitation	_____ Discussion	_____ Indep. Study
	_____ Clinical	_____ Colloquium	_____ Practicum	_____ Research	_____ Residency
	_____ Seminar	_____ Studio	_____ Other – Please explain:	_____	
Proposed:	*2 Lecture*	*_____ Laboratory*	*1 Recitation*	*_____ Discussion*	*_____ Indep. Study*
	_____ Clinical	*_____ Colloquium*	*_____ Practicum*	*_____ Research*	*_____ Residency*
	_____ Seminar	*_____ Studio*	*_____ Other – Please explain:*	*_____*	

f. **Current Grading System:** ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

Proposed Grading System: ☒ *Letter (A, B, C, etc.)* ☐ *Pass/Fail*

g. **Current number of credit hours:** 3 — *Proposed number of credit hours:* *3*

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[1] See comment description regarding minor course change. *Minor changes are sent directly from dean's office to Senate Council Chair.* If Chair deems the change as "not minor," the form will be sent to appropriate academic Council for normal processing and contact person is informed.

[2] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[3] Signature of the chair of the cross-listing department is required on the Signature Routing Log.

[4] Removing a cross-listing does not drop the other course – it merely unlinks the two courses.

[5] Generally, undergrad courses are developed such that one semester hr of credit represents 1 hr of classroom meeting per wk for a semester, exclusive of any lab meeting. Lab meeting generally represents at least two hrs per wk for a semester for 1 credit hour. (See *SR 5.2.1.*)

COURSE CHANGE FORM

h.	**Currently, is this course repeatable for additional credit?**	YES ☐	NO ☒
	Proposed to be repeatable for additional credit?	*YES* ☐	*NO* ☒
	If YES: *Maximum number of credit hours:* _____		
	If YES: *Will this course allow multiple registrations during the same semester?*	*YES* ☐	*NO* ☐
i.	**Current Course Description for Bulletin:**	Introduction to biosystems engineering: engineering problem solving; computer applications and structured programming; probability; and statistics. Emphasis on application of these skills to biosystems applications.	
	Proposed Course Description for Bulletin:	*Introduction to statistics and statistical inference reasoning. Evaluation of common claims based on statistical constructs, hypothesis tests, margins of error, confidence intervals, and analysis of variation. Identification of possible statistical obstacles, such as confounding, missing data, and inappropriate randomness. Conceptual statistics will be emphasized. Special attention will be given to include biosystems engineering problems.*	
j.	**Current Prerequisites, if any:**	MA 114, BAE 201	
	Proposed Prerequisites, if any:	*MA 114*	
k.	Current Distance Learning(DL) Status: ☒ N/A	☐ Already approved for DL*	☐ *Please Add*[6] ☐ *Please Drop*
	*If already approved for DL, the Distance Learning Form must also be submitted unless the department affirms (by checking this box ☐) that the proposed changes do not affect DL delivery.		
l.	**Current Supplementary Teaching Component, if any:**	☐ Community-Based Experience ☐ Service Learning	☐ Both
	Proposed Supplementary Teaching Component:	☐ *Community-Based Experience* ☐ *Service Learning*	☐ *Both*
3.	**Currently, is this course taught off campus?**	YES ☐	NO ☒
	Proposed to be taught off campus?	YES ☐	NO ☒
4.	**Are significant changes in content/teaching objectives of the course being proposed?**	YES ☒	NO ☐
	If YES, explain and offer brief rationale:		
	The content of the course is being revised to emphasize statistical inferential reasoning, such that this course meets the University's general education requirement. The course has always had a lot of discussion about statistical inferences, but meeting the general education requirement requires a change in the course description. In addition, less structured programming will be done in this course, because CS 221 has updated coverage of Matlab.		
5.	**Course Relationship to Program(s).**		
a.	**Are there other depts and/or pgms that could be affected by the proposed change?**	YES ☐	NO ☒
	If YES, identify the depts. and/or pgms: _____		
b.	**Will modifying this course result in a new requirement[7] for ANY program?**	YES ☐	NO ☒
	If YES[7], list the program(s) here: _____		
6.	**Information to be Placed on Syllabus.**		

[6] You must *also* submit the Distance Learning Form in order for the course to be considered for DL delivery.
[7] In order to change a program, a program change form must also be submitted.

COURSE CHANGE FORM

a.	☐	Check box if changed to 400G or 500.	If changed to 400G- or 500-level course you must send in a syllabus and *you must include the differentiation* between undergraduate and graduate students by: (i) requiring additional assignments by the graduate students; and/or (ii) establishing different grading criteria in the course for graduate students. (See *SR 3.1.4.*)

COURSE CHANGE FORM

Signature Routing Log

General Information:

Course Prefix and Number: BAE 202

Proposal Contact Person Name: Czar Crofcheck Phone: 7-3000 Email: crofcheck@uky.edu

INSTRUCTIONS:

Identify the groups or individuals reviewing the proposal; note the date of approval; offer a contact person for each entry; and obtain signature of person authorized to report approval.

Internal College Approvals and Course Cross-listing Approvals:

Reviewing Group	Date Approved	Contact Person (name/phone/email)	Signature
Scott A. Shearer	3-7-11	7-3000/ x127 Scott. A. Shearer @uky.edu	
Engineering faculty	4-11-11	Richard Swergard / 78827 / rswergar@engr.uky.edu	
		/ /	
		/ /	
		/ /	

External-to-College Approvals:

Council	Date Approved	Signature	Approval of Revision[8]
Undergraduate Council	7/13/2011	Sharon Gill Digitally signed by Sharon Gill DN: cn=Sharon Gill, o=Undergraduate Education, ou=Undergraduate Council, email=sgill@uky.edu, c=US Date: 2011.09.20 14:14:34 -04'00'	
Graduate Council			
Health Care Colleges Council			
Senate Council Approval		University Senate Approval	

Comments:

[8] Councils use this space to indicate approval of revisions made subsequent to that council's approval, if deemed necessary by the revising council.

BAE 202: Statistical Inferences for Biosystems

Cover Sheet for the Vetting Team

Important Information for the Vetting Team

The Biosystems Engineering program has included a probability and statistics course since 1991. The faculty of the department added the course so that our graduates would be well prepared to use statistical inferences in the engineering workplace, but also in their daily lives outside of engineering. The class has always had a strong focus on "why should you care about statistics and this is how you can use statistics in your everyday life." Hence, the evolution of the course to meet the general education requirements has been a simple process. In previous years, the inclusion of computer software programming was required. However, due to shifts in other course offerings in the curriculum, there is no need to cover this material. As a result, there will be significant class time freed up in order to make sure that statistical inferences are thoroughly covered.

A breakdown of the lecture/recitation distribution with respect to the SIR template outcomes is included in this cover sheet. Material previously covered in the course is denoted by an accompanying chapter number. While the lecture/recitation will include some instruction on how to do the computations associated with the topic, this will **not** be the main focus. *(Considering the students will all be engineering students, the inclusion of computation instruction will enhance their learning of the topic as opposed to interfering with it.)* **All** questions on homework or exams will be posed within the context of a word problem, such that every computation will be accompanied by an inference or conclusion. **All** exams will be open book, such that the exam will focus on testing the students' abilities to make inferences and conclusion. Recitation will be focused on advancement of conceptual understanding and the case studies. The goal will be for the students to learn to make statistical inferences for use with issues that they will encounter in their daily life and in engineering. For the new class, specific lecture/recitation time has been set aside to be sure the template outcomes are addressed rigorously (denoted as "SIR" in the table). The modules covered in the "SIR" denoted lecture/recitations will be focused on further emphasizing the concepts discussed in the Chapter lectures.

Template Outcome	Number of Class Hours	Actual	Required
A	9.5	25%	25%
B	13	34%	25%
C	8	21%	20%
D	2	5%	5%
Other	5.5	14%	
Total	39	100%	75%

Topics to be covered under the various outcomes include:

SIR A: *Sampling Variability* - good vs. bad surveys, various poll types, sampling variability and non-sampling variability, margin of error, poll comparisons, sampling distributions, confidence intervals

Big Question: Garbage in, garbage out?

SIR B: *Statistical Inferences* - sensitivity vs. specificity, dichotomous decision process, hypothesis tests, significance and power

Big Question: Is it "significant"?

SIR C: *Evaluate Common Claims* -good vs. bad statistical summaries (charts, graphs, summaries), correlation vs causation, confounding and its effect, Simpson's paradox, misinterpretation of randomness, missing information, prosecutor's fallacy, conditional events vs non-conditional events

Big Question: Are poor human inferences common?

SIR D: *Information Literacy* - Extensive use of outside literature will be used when addressing all of the other outcomes.

Big Question: Can we believe everything we read?

Assessable Artifacts:
The assessable artifacts will be based on four written reports, the Bioprocessing Lab (SIR A), the Environmental Case Study (SIR B), the Machinery Case Study (SIR C), and the Greenhouse Case Study (SIRs A, B, C, and D).

Bioprocessing Case Study: *surveys/polls, sample variability, sampling distributions and confidence intervals.*
Students will be asked to consider that they are working in a flavor manufacturing company. Part I of the Case Study will focus on the appropriateness of building a survey for a food panel. Part II will deal with the sampling variability of "natural flavor" components coming into the plant. Part III will deal with the confidence interval that is acceptable on the production line.

Environmental Case Study: *sensitivity vs. specificity, hypothesis tests, significance and power*
Students will be asked to consider that they are working at an environmental engineering firm. Part I of the Case Study will cover sensitivity vs. specificity with respect to measuring environmental contaminates. Part II will deal with determining whether a mine site has been restored to an acceptable condition.

Machinery Case Study: *good vs. bad statistical summaries (charts, graphs, summaries), correlation vs causation, confounding and its effect, Simpson's paradox, misinterpretation of randomness, missing information, prosecutor's fallacy*
Students will be asked to consider that they are working at an engine manufacturing company. The students will be provided with charts and summaries from various potential vendors. Part I will ask the students to decide what information to use and what information will be deemed problematic. Part II will be based on data that supports prosecutor's fallacy. Part III will focus on Simpson's paradox.

Greenhouse Case Study: *confidence intervals, hypothesis tests, conditional events vs non-conditional events, information literacy.*
Students will be asked to consider that they are working for a large greenhouse company that is interested in building a facility to grow poinsettia plants. Students will be asked to devise an experimental plan to test what is the best temperature and watering schedule to be used to grow poinsettia plants. Only after a satisfactory experimental plan has been devised will the students be provided with data to analyze. In addition, they will be asked to decide whether the growth behavior is dependent on the color of the poinsettia plant.

Biosystems and Agricultural Engineering
University of Kentucky
BAE 202: Statistical Inferences for Biosystems Engineers
Spring 2011

Instructor: Dr. Czarena Crofcheck
Rm 212 CE Barnhart Building
257-3000 ext. 212
crofcheck@uky.edu

Class Times: Lecture: MW 1:00-1:50 in Rm 236
Recitation: F 1:00-1:50 in Rm 236

Office Hours: By appointment or whenever my door is open.

This course has been developed to meet the "statistical inferential reasoning" (SIR) requirement of the University's new general education program. The goal of this general education requirement is to prepare you to make statistical inferences in your daily life. The goal of this course is to provide you an opportunity to develop your expertise in statistical inferences related to your daily life and to your life as an engineer.

Course Description: Introduction to statistics and statistical inference reasoning. Evaluation of common claims based on statistical constructs, hypothesis tests, margins of error, confidence intervals, and analysis of variation. Identification of possible statistical obstacles, such as confounding, missing data, and inappropriate randomness. Conceptual statistics will be emphasized. Special attention will be given to include biosystems engineering problems.

Prerequisites: MA 114

Student Learning Outcomes: At the end of this class a successful student will have:

1) an understanding of statistics and statistical inferences,
2) an understanding of sampling variability and quantifying risk.
3) the ability to draw sound conclusions based on null hypothesis testing, and
4) the ability to evaluate common claims that arise from statistical constructs.
   An ability to independently identify and use appropriate information resources from a variety of sources.

Required Materials:
The Basic Practices of Statistics. 2010. W. H. Freeman and Company, New York, NY, 5th Edition.

Grading: Grades will be assigned on a straight scale basis (100-90% A, 80-89% B, 70-79% C, 60-69% D, and 59% or below E). Final grades will be basis on the following distribution:

Homework/quizzes/in-class assignments:	20%
Case Studies:	40%
Midterms (3):	20%
Final Exam:	20%

Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar (http://www.uky.edu/Registrar/AcademicCalendar.htm) .

Additional Resources:

- Stat-Spotting: A Field Guide to Identifying Dubious Data, by Joel Best.
- What is a p-value anyway?, by Andrew Vickers.
- Miller & Freund's Probability and Statistics for Engineers. 2004. Prentice-Hall, Inc. NY, NY 7th Edition.

Excused Absences:

Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

Verification of Absences:

Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

Academic Integrity:

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of

academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of Student Rights and Responsibilities (available online http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

Accommodations due to disability :
If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address: jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Classroom conduct: Cell phones should be silent (no talking or texting) during class and recitation periods. I typically distribute handouts at the beginning of class. If you are late to class, it is your responsibility to come to the front of the class and pick up handouts, if you miss a day it is your responsibility to get a copy of the handout.

Academic Accommodations Due to Disability: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Assignments:

Class Assignments

Homework will typically be assigned each Monday and will be due the following **Monday**. These assignments should be done on engineering paper. Assignments should include: (a) identification of the given and unknown information, (b) calculations (final and intermediate), and (c) the final answer underlined (boxed or circled is acceptable as well). You may **discuss** with other students your approach to solving problems, but ultimately the work must be done on your own (as a rule of thumb every calculated number on your assignment should go through your calculator). The homework assignments will give you the opportunity to work with the concepts discussed in class, on your problems solving skills, and on your ability to convey to a second party the method by which you solved the problems. For this reason, your homework grade will be based on whether you (a) provide the correct answer, (b) used the correct method, and (c) present the answer and method in a clear and concise manner (in other words, NEATNESS COUNTS). If your assignment is more than one page, which it should be, you must staple the sheets, avoid paper clips. If you are absent on a Monday, you should get the assignment from a classmate before coming to class on Wednesday.

Lecture Reading

The course outline includes section numbers that will be covered in each lecture; it is your responsibility to have these sections read BEFORE it will be covered in lecture. Please take the reading assignments seriously. The lecture and lab material will be easier to understand if you have completed your reading assignments on time.

Throughout the course contemporary articles will be included as part of the lecture reading. These articles will compliment the textbook material and contribute to the information literacy aspect of the course. The final week of the course will focus solely on contemporary articles and serve as a review of the statistical inferences topics studied over the entire semester.

Late work

All homework assignments are due at the beginning of class (or upon your arrival to class). You may turn homework assignments in late, but there is no guarantee that it will be graded or recorded. Homework will typically be graded the day after it is assigned and homework that is turned in after an assignment has been graded will not be graded or recorded. If you have an excused absence you may turn in late homework the following class period, but no later. If you miss more than two days with an excused absence a make-up assignment may be assigned.

Paper vs. electronic file

Unless otherwise specified, you must always turn assignments in on paper. In some instances, you will be required to email me a copy of your file. On such occasions, you are REQUIRED to use your name in the filename of that file.

BAE 202 Statistical Inferences for Biosystems Engineers – Spring 2011

lecture & recitation	Topics	Moore Chapter	SIR
12-Jan	Introduction		ABCD
14-Jan, 19-Jan	Effective vs misleading statistical constructs (charts, graphs, summaries)	1,2	C
21-Jan, 24-Jan	Normal distributions	3	C
26-Jan, 28-Jan	Association versus correlation; correlation & causation; confounding and its effect	4	C
31-Jan, 2-Feb, 4-Feb	Correlation & causation, regression	5	C
2-Feb, 4-Feb	Simpson's paradox, two-way tables	6	C
7-Feb	**Exploring Data Review (SIR C)** Misinterpreting randomness, missing information	7	C
9-Feb	**EXAM 1 (SIR C)**		C
11-Feb	Sampling	8	A
14-Feb, 18-Feb	Statistically designed experiments	9	B
16-Feb, 18-Feb	Probability	10	A
21-Feb, 23-Feb, 25-Feb	Uncertainty of sampling variability, sampling distributions, central limit theorem	11	A
28-feb, 4-Mar	Rules of probability	12	A
2-Mar, 4-Mar	Binomial distributions	13	A
7-Mar, 11-Mar	Biased samples and questionnaires; standard scores, intro to inference, p-value, hypothesis, CI	14	A
9-Mar, 11-Mar	Margins of error, confidence intervals	15	A
11-Mar	**From Exploration to Inference Review (SIR A)** Quantifying risk of practical interest	15	A
21-Mar	**EXAM 2 (SIR A)**		A
23-Mar, 25-Mar	Hypothesis testing, inferences about a population mean, t-dist, matched pairs	17	B
28-Mar, 30-Mar, 1-Apr	Two-sample problems	18	B
1-Apr, 18-Apr	**Inferences about Variables Review (SIR B)** Conceptual understanding of statistical significance; strengths and weaknesses of classical null hypothesis testing; evidence against a claim	21	B
4-Apr, 6-Apr, 8-Apr	Inference for Regression	23	B
11-Apr, 13-Apr, 15-Apr	ANOVAs	24	B
20-Apr	Review		B
22-Apr	**Exam 3 (SIR B)**		B
25-Apr, 27-Apr, 1-May	Information Literacy		D
4-May	Final		

BAE 202 Statistical Inferences for Biosystems Engineers - Recitation Schedule – Spring 2011

recitation	Topics	Moore Chapter
28-Jan	Association versus correlation; correlation & causation; confounding and its effect	4
4-Feb	**Exploring Data Review – *Machinery Case Study (SIR C)***	5
11-Feb	Sampling	8
18-Feb	Statistically designed experiments, Probability	9
25-Feb	Uncertainty of sampling variability, sampling distributions, central limit theorem	11
4-Mar	Rules of probability, Binomial distributions	12
11-Mar	**From Exploration to Inference Review – *Bioprocessing Case Study (SIR A)***	14
25-Mar	Hypothesis testing, inferences about a population mean, t-dist, matched pairs	17
1-Apr	**Inferences about Variables Review – *Environmental Case Study (SIR B)***	21
8-Apr	Assign ***Greenhouse Case Study (SIR ABCD)*** & Inference for Regression	23
15-Apr	ANOVAs	24
22-Apr	**Exam 3**	
1-May	Information Literacy	

The assessable artifacts will be based on four written reports, the Bioprocessing Case Study (SIR A), the Environmental Case Study (SIR B), the Machinery Case Study (SIR C), and the Greenhouse Case Study (SIRs A, B, C, and D). Material and discussions specific to the case studies will be included in the recitations.

Bioprocessing Case Study: surveys/polls, sample variability, sampling distributions, margin of error, confidence intervals, and quantifying risk of practical interest.

Students will be asked to consider that they are working in a flavor manufacturing company. Part I of the Case Study will focus on the appropriateness of building a survey for a food panel. Part II will deal with the sampling variability of "natural flavor" components coming into the plant. Part III will deal with deciding acceptable product quality from the production line based on confidence intervals. The students will be asked to use statistical inferential reasoning to determine whether of not the new flavor should be manufactured.

Environmental Case Study: statistically designed experiments, null hypothesis testing, quantifying risk, conceptual understanding of statistical significance, strengths and weaknesses of classical null hypothesis testing, and evidence against a claim.

Students will be asked to consider that they are working at an environmental engineering firm. Part I of the Case Study will address the basic language of statistical experimental design with respect to

measuring environmental contaminates. Interpretation of statistical inferences conveyed through null hypothesis testing will be addressed, including strengths and weaknesses of this approach. Part II will deal with determining whether a reclaimed surface mine site has been restored to an acceptable condition.

Machinery Case Study: effective vs misleading statistical constructs (charts, graphs, summaries), association vs correlation and/or causation, confounding and its effect, Simpson's paradox, misinterpretation of randomness, missing information, prosecutor's paradox.

Students will be asked to consider that they are working at an engine manufacturing company. The students will be provided with charts and summaries from various potential vendors. Part I will ask the students to decide what information to use and what information will be deemed problematic. Part II will be based on data that supports prosecutor's fallacy. Part III will focus on Simpson's paradox.

Greenhouse Case Study: confidence intervals, hypothesis tests, conditional events vs non-conditional events, information literacy.

Students will be asked to consider that they are working for a large greenhouse company that is interested in building a facility to grow poinsettia plants. Students will be required to independently identify and use appropriate resources to determine the cultivation requirements of poinsettias and typical greenhouse control schemes. Students will be asked to devise an experimental plan to determine the best temperature and watering schedule to grow poinsettia plants. Only after a satisfactory experimental plan has been devised will the students be provided with data to analyze. In addition, they will be asked to decide whether the growth behavior is dependent on the color of the poinsettia plant.