ARIZONA STATE UNIVERSITY

GENERAL STUDIES COURSE PROPOSAL COVER FORM

Course information:

*Copy and paste **current** course information from Class Search/Course Catalog.*

Academic Unit: **School of Sustainability** Department: **School of Sustainability**

Subject: **SOS** Number: **211** Title: Calculus and Probability for the Life and Social Sciences Units: 3

Is this a cross-listed course? No
If yes, please identify course(s)

Is this a shared course? No If so, list all academic units offering this course

Course description:
Introduces two of the most important and useful mathematical frameworks used to study natural and social phenomena: probability and calculus. Probability is used to describe an attitude of mind toward some proposition whose truth is not certain. Calculus is the branch of mathematics used to study the behavior and dynamics of functions: calculus is the mathematical study of change. Students gain the basic competence needed for applying probability and calculus when thinking about and research problems in sustainability. Focuses on and discusses applications, the meaning of important concepts, the origins of the rules of derivation and integration, and logic behind why the methods work.

Requested designation: Mathematical Studies-MA

*Note- a **separate** proposal is required for each designation requested*

Eligibility:

Permanent numbered courses must have completed the university's review and approval process.
For the rules governing approval of omnibus courses, contact the General Studies Program Office at (480) 965-0739.

Area(s) proposed course will serve:

A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study.

Checklists for general studies designations:

Complete and attach the appropriate checklist

- Literacy and Critical Inquiry core courses (L)
- Mathematics core courses (MA)
- Computer/statistics/quantitative applications core courses (CS)
- Humanities, Fine Arts and Design core courses (HU)
- Social and Behavioral Sciences core courses (SB)
- Natural Sciences core courses (SQ/SG)
- Global Awareness courses (G)
- Historical Awareness courses (H)
- Cultural Diversity in the United States courses (C)

A complete proposal should include:

- ☒ Signed General Studies Program Course Proposal Cover Form
- ☒ Criteria Checklist for the area
- ☒ Course Syllabus
- ☒ Table of Contents from the textbook, and/or lists of course materials

Contact information:

Name: Caroline J Harrison Phone: 480-965-8645

Mail code: 5502 E-mail: caroline.harrison@asu.edu

Department Chair/Director approval: *(Required)*

Chair/Director name (Typed): Christopher G. Boone Date: Oct 10, 2013

Rev. 1/94, 4/95, 7/98, 4/00, 1/02, 10/08, 11/11/ 12/11, 7/12

Arizona State University Criteria Checklist for

MATHEMATICAL STUDIES [MA]

Rationale and Objectives

The **Mathematical Studies** requirement is intended to ensure that students have skill in basic mathematics, can use mathematical analysis in their chosen fields, and can understand how computers can make mathematical analysis more powerful and efficient. The **Mathematical Studies** requirement is completed by satisfying both the **Mathematics [MA]** requirement and the **Computer/Statistics/Quantitative Applications [CS]** requirement explained below.

The **Mathematics [MA]** requirement, which ensures the acquisition of essential skill in basic mathematics, requires the student to complete a course in College Algebra, College Mathematics, or Precalculus, or demonstrate a higher level of skill by completing a mathematics course for which College Algebra is a prerequisite.

The **Computer/Statistics/Quantitative Applications [CS]** requirement, which ensures skill in real world problem solving and analysis, requires the student to complete a course that uses some combination of computers, statistics, and mathematics.

Revised MA March 2011

Proposer: Please complete the following section and attach appropriate documentation.

ASU--[MA] CRITERIA			
A MATHEMATICS [MA] COURSE MUST SATISFY ALL OF THE FOLLOWING CRITERIA:			
YES	**NO**		**Identify Documentation Submitted**
☒	☐	**1.** Mathematics course with a minimum prerequisite of Intermediate Algebra or a course already approved as satisfying the MA requirement.	
☒	☐	**2.** Applies mathematical skills in the solution of real life problems.	
		3. Introduces or makes significant use of all of the following mathematical skills and concepts:	
☒	☐	**a.** Manipulation of mathematical expressions.	
☒	☐	**b.** Functions and their various forms of expression (algebraic, graphic, and numeric).	
☒	☐	**c.** Problem solving using mathematics.	
☒	☐	**d.** Quantitative literacy.	
		4. Acceptable courses include (check applicable course):	
☐	☐	**a.** College Mathematics	
☐	☐	**b.** College Algebra	
☐	☐	**c.** Precalculus	
☐	☐	**d.** Any mathematics course with College Algebra as a prerequisite	
☒	☐	**e.** Any mathematics course with any of its prerequisite courses satisfying the MA criteria.	

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Course Prefix	Number	Title	Designation
SOS	211	Calculus and Probability	MA

Explain in detail which student activities correspond to the specific designation criteria. Please use the following organizer to explain how the criteria are being met.

Criteria (from checksheet)	How course meets spirit (contextualize specific examples in next column)	Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)
1. Mathematics course with a minimum prerequisite of Intermediate Algebra or a course already approved as satisfying the MA requirement.	Course requires SOS 101 (MA)	See pre-requisites on attached syllabus
2. Applies mathematical skills in the solution of real life problems.	Real world appliations and examples used throughout	See description and topics in Syllabus
3. Introduces or makes significant use of all of the following mathematical skills and concepts:	Covers all listed concepts	See syllabus for list of topics covered.

SOS 211: Calculus and Probability for the Life and Social Sciences

Introduces two of the most important and useful mathematical frameworks used to study natural and social phenomena: probability and calculus. Probability is used to describe an attitude of mind toward some proposition whose truth is not certain. Calculus is the branch of mathematics used to study the behavior and dynamics of functions: calculus is the mathematical study of change. Students gain the basic competence needed for applying probability and calculus when thinking about and research problems in sustainability. Focuses on and discusses applications, the meaning of important concepts, the origins of the rules of derivation and integration, and logic behind why the methods work.

General Studies Review Color Key to MA Criteria:

1. Mathematics course with a minimum prerequisite of Intermediate Algebra or a course already approved as satisfying the MA requirement.

2. Applies mathematical skills in the solution of real life problems.

3. Introduces or makes significant use of all of the following mathematical skills and concepts:

   a. Manipulation of mathematical expressions.

   b. Functions and their various forms of expression (algebraic, graphic, and numeric).

   c. Problem solving using mathematics.

   d. Quantitative literacy.

4. Acceptable courses include (check applicable course):

   e. Any mathematics course with any of its prerequisite courses satisfying the MA criteria.

: ARIZONA STATE UNIVERSITY

SOS 211: Calculus and Probability

3 Units

The goals of this course are to introduce the student to two of the most important and useful mathematical frameworks used to study natural and social phenomena: *probability* and *calculus*.

Probability is used to describe an attitude of mind towards some proposition whose truth is not certain. The proposition of interest is usually of the form "Will a specific event occur?" The attitude of mind is of the form "How confident are we that the event in question will occur?" The certainty we adopt can be described in terms of a numerical measure and this number, between 0 and 1, we call probability. The higher the probability of an event, the more certain we are that the event will occur. *Probability theory is the branch of mathematics which deals with calculating probabilities using available data; probability theory is, in effect, the mathematics of dealing with uncertainty.* A question common to all of the natural and social sciences is to understand change: how, and how fast, do important features of systems change through time and as a result of the system being acted on or affected by other systems.

The mathematical thread connecting the course's two topics is the notion of a function. The most common way to mathematically represent relationships in natural and social systems is by using *functions.* In mathematics, a function is a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output. Functions are the essential ingredient in building mathematical functions—and the study of change is carried out through studying how functions change. Calculus is the branch of mathematics used to study the behavior and dynamics of functions: *calculus is the mathematical study of change.* In the modern view of probability a *probability function* assigns a measure of how likely an event is to happen.

After taking this course the student should have the basic competence needed for applying probability and the calculus when thinking about and research problems in sustainability, and for studying more advanced mathematics—such as intermediate courses in statistics and calculus— as well as courses which presume familiarity with probability and calculus (such as microeconomics and macroeconomics). Although the focus of the course will be on applications, the meaning of important concepts, the origins of the rules of derivation and integration, and logic behind why the methods work will be discussed. And yes, students will be given the opportunity to experience the unique pleasure of building mathematical proofs.

Textbook: *Calculus and Its Applications, Books a la Carte Edition,* Marvin L. Bittinger, David J. Ellenbogen, Scott Surgent, 10rd edition, Pearson (2013)

Pre-requisites: Students should have taken high school algebra, and SOS 101 or AML 100 or MAT 177. No prior exposure to probability theory or calculus is assumed. The main pre-requisites, however, are for the student to have an inquisitive disposition, a willingness to read critically (and copiously), think carefully, listen attentively, inquire actively, and to probe assumptions.

Goals of the Course:

- to gain experience thinking in an evidence-based manner
- to learn what is a model and what does modeling consist of
- to learn about probabilistic reasoning
- to learn the basic elements of probability and calculus
- to learn how to use probability and the calculus to analyze problems in the social sciences

Blackboard site: the instructor will often use the course's blackboard web site to communicate information and updates to the students so they are advised to visit the website frequently. Assignments will be made available through the blackboard site, and the answers to the assignments and the quizzes will be posted in the site.

Homework will be assigned weekly and "graded" throughout the course. The homework consists of a selection of problems from Allman and Rhodes (2006) and problems defined by the instructor. The homework assignments will consist of algebraic, computational and graphical ways to solve mathematical problems.

Students are encouraged to work together on homework, but each individual student is required to write up and turn in his own work.

Attendance: Attendance is required. If you miss more than three classes, there will be a penalty of 5 percentage points of your final grade.

Examinations: There will be two exams given during the course. The examinations will cover material as indicated in the schedule, and will involve a mix of mechanical skills and conceptual reasoning. Each exam will consist of a number of problems, which are similar to homework, but they may also represent applications of principles in entirely different circumstances. The best possible preparation for the exams is regular attendance and completion of assigned homework. The exams will be open book and open notebook (as will the final); students will need to use a calculator during quizzes (and the final examination) but will not be permitted to use a laptop or cell phone as a calculation device. Memorization of formulas is not necessary and will not be sufficient for obtaining high grades on examinations.

Requests to reschedule examinations due to religious holidays or for other legitimate reasons must be made via e-mail two weeks before the examination's scheduled date. Makeup exams are given at the instructor's discretion and only in the case of verified medical or other emergencies, which must be documented. The instructor must be notified before the test is given. It is best to discuss scheduling conflicts as soon as possible.

Examinations are governed by the following policies:

1. There will be **no make-up examinations**.
2. **Academic dishonesty** on an examination will result automatically in a failing grade for the course and referral to the Dean for further sanctions. *Cheating in any form will not be tolerated!*
3. The use of **hand calculators** of any kind is permitted. Students may not wear headphones of any kind during the exam. All cell phones and other electronic devices must be put away and may not be used during the examination.
4. Examination paper (including scratch paper) will be provided. Bring only your pencils and calculators.
5. **Partial credit** is given. Arithmetical errors will be treated charitably, but for answers that do not make sense (wrong dimensions, deviation by several orders of magnitude, etc.) no credit will be awarded. Always examine your solutions for reasonableness.
6. In the event of a **fire alarm** occurring during an examination, students will be asked to close their examination booklets, gather their belongings and leave the room as expeditiously as possible, leaving their examination booklets on the tables where they were working. The booklets will be gathered and graded as they are. Unless the alarm proves to represent a *bona fide* emergency, there will be no make-up examination.

If a student believes there to have been an **error in grading** his or her examination, the complaint should be put in writing and handed, together with the examination, to the course instructor. The problem will be re-graded by the individual who graded it originally. If the student is not satisfied with the grader's response to the complaint, he or she may appeal to the course instructor. In this event, the instructor reserves the prerogative to re-grade the entire examination. (Simple errors, such as point addition, can be corrected by the student's recitation section instructor without the need for a written appeal.)

Final Grades: the final course grades will be based on the homeworks and examinations with the following weights.

Homework assignments	50 %
Midterm exam	20 %
Final exam	30 %

Your final grade will be computed to the nearest whole number (For example, 87.4 = 87, not 88)
and your final letter grade will be based on the following table:

A+	>95%	B+	79-83%	C+	64-68%	E	<47%
A	88-94%	B	74-78%	C	58-63%		
A-	84-87%	B-	69-73%	D	47-57%		

There will be no "grading under the curve" in the course. Students' final grade will be strictly and solely based on the weighted sum of these three components.

Incompletes: a mark of "I" (incomplete) is given by the instructor when you are otherwise doing acceptable work but are unable to complete the course because of illness or other conditions beyond your control. You are required to arrange with the instructor for the completion of the course requirements. The arrangement must be recorded on the Request for Grade of Incomplete form (http://students.asu.edu/forms/incomplete-grade-request).

Late Assignments: unexcused late assignments will not be accepted. Excuses for an assignment must be made and approved in advance of the due date of the assignment. Requests for excuses must be communicated via email one week before the assignment's due date. In order to receive credit for the excused late assignment you must turn in a copy of the email approval or signed written excuse.

Course Policies: cell phones, ipods, MP3 players, any other electronic media (as well as percussion instruments) cannot be used, and must be turned off, during the lectures, exams and final examination. You may use a laptop during lectures only as a means to take notes. A student found to be texting during the lecture will be asked to leave the classroom.

Student Standards: students are required to read and act in accordance with university and Arizona Board of Regents policies, including:

> The ABOR Code of Conduct: Arizona Board of Regents Policies 5-301 through 5-308: http://www.abor.asu.edu/1_the_regents/policymanual/chap5/5Section_C.pdf

Academic Integrity: all students are responsible for reviewing and following ASU's policies on academic integrity: http://provost.asu.edu/academicintegrity. If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, school, and/or dean. Academic dishonesty includes borrowing ideas without proper citation, copying others' work (including information posted on the internet), and failing to turn in your own work for group projects. Please be aware that if you follow an argument closely, even if it is not directly quoted, you must provide a citation to the publication, including the author, date and page number. If you directly quote a source, you must use quotation marks and provide the same sort of citation for each quoted sentence or phrase. You may work with other students on assignments; however, all writing that you turn in must be done independently. If you have

any doubt about whether the form of cooperation you contemplate is acceptable, ask the TA's or the instructor in advance of turning in an assignment. Please be aware that the work of all students submitted electronically can be scanned using SafeAssignment, which compares them against everything posted on the internet, online article/paper databases, newspapers and magazines, and papers submitted by other students.

Student Support and Disability Accommodations: ASU offers support services through Counseling (students.asu.edu/counseling), the Learning Resources Center (www.asu.edu/lrc), and the Disability Resource Center (www.asu.edu/studentaffairs/ed/drc/). If you are a student in need of special arrangements for we will do all we can to help, based on the recommendations of these services. For the sake of equity for all students, we cannot make any accommodations without formal guidance from these services.

Email Communications: all email communication for this class will be done through your ASU email account. You should be in the habit of checking your ASU email regularly, as well as the course's blackboard site, as you will not only receive important information about your class(es), but other important university updates and information. You are solely responsible for reading and responding if necessary to any information communicated via email.
TA/Tutoring Support: students are encouraged to ask questions during lectures, and to avail themselves of the Instructor's and Teaching Assistants' office hours to discuss questions in depth and clarify issues. Note that office hours are a complement to lectures and are not meant to substitute for attending them. As an ASU student you have access to many resources on campus. This includes tutoring, academic success coaching, counseling services, financial aid, disability resources, career and internship help and many opportunities to get involved in student clubs and organizations.

- Tutoring: http://studentsuccess.asu.edu/node/24
- Learning Support Services: http://www.asu.edu/studentaffairs/lss/
- Counseling Services: http://students.asu.edu/counseling
- Financial Aid: http://students.asu.edu/financialaid
- Disability Resource Center: http://www.asu.edu/studentaffairs/ed/drc/
- Major/Career Exploration: http://uc.asu.edu/majorexploration/assessment
- Career Services: http://students.asu.edu/career
- Student Organizations: http://www.asu.edu/studentaffairs/mu/clubs/

Withdrawal: withdrawal policies are established by the University. Please check the University's website for the relevant deadlines.

List of

Topics *Week 1:*	*Models and Modeling*
Week 2:	*Dynamical Systems*
Week 3:	*Limits*
Week 4:	*Derivatives*
Week 5:	*Applications of Differentiation*
I Week 6:	*Applications of Differentiation*
II Week 7:	*Integrals I*
Week 8:	*Integrals II*
Week 9	*Fundamental Theorem of the Calculus*
Week 10:	*Applications of Integration*
Week 11:	*Probability I*
Week 12:	*Probability II*
Week 13:	*Random Variables and Probabilistic Models*
Week 14:	*Statistical Reasoning I*
Week 15:	*Statistical Reasoning II*
Week 16:	*Review for Final*

- **Calculus and Its Applications, Expanded Version, Books a la Carte Edition**

Marvin L. Bittinger, *Indiana University - Purdue University at Indianapolis*
David J. Ellenbogen, *Community College of Vermont*
Scott Surgent, *Arizona State University*

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6.1 Functions of Several Variables
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6.4 An Application: The Least-Squares Technique
6.5 Constrained Optimization
6.6 Double Integrals

7. Trigonometric Functions

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7.2 Derivatives of Trigonometric Functions
7.3 Integration of Trigonometric Functions
7.4 Inverse Trigonometric Functions and Applications

8. Differential Equations

8.1 Differential Equations
8.2 Separable Differential Equations
8.3 Applications: Inhibited Growth Models
8.4 First-Order Linear Differential Equations
8.5 Higher-Order Differential Equations and a Trigonometry C onnection

9. Sequences and Series

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9.2 Geometric Sequences and Series
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