MATH 147 - 510/511/512 - Calculus I for Biological Sciences - Fall 2014

Lecture: MWF 10:20am-11:10am in Blocker 166
Recitation:

Section 510	TR 9:35-10:25am in THOM 107A
Section 511	TR 11:10-12:00pm in C E 203
Section 512	TR 12:45-1:35pm in C E 223

Instructor: Prof. Anne Shiu, Blocker 601E, annejls@tamu.edu
Course webpage: http://www.math.tamu.edu/~annejls/teaching/147-fall14.html
Office hours: Mondays and Wednesdays, 2-3:30pm, and by appointment
Teaching Assistant: Xiaosi Tan, xstan@math.tamu.edu

Required Text: *Calculus for Biology and Medicine,* (3rd edition), C. Neuhauser, Pearson (2010), ISBN: 0321644689.

Course Description: Introduction to differential calculus in a context that emphasizes applications in the biological sciences. Topics will included limits, continuity, differentiation and applications, integration and applications. This course meets three times per week in lecture (MWF) and twice per week in recitation (TR). In recitation, students will work on assignments/exercises, discuss homework questions, and complete weekly quizzes.

Homework: Homework will be due each week on Thursday at the beginning of recitation. Staple your homework, and remove frayed edges from paper torn from spiral notebooks. Additionally, homework solutions must be clear and well-organized; the grader will impose a 10% penalty for solutions that are lacking in clarity. Group work is encouraged, but please write up your solutions independently. Late homework is not accepted.

Help Session: Math Department help sessions for MATH 147 will be offered. *This is an excellent source of help*. The schedule will be posted here: http://math/courses/helpsessions.html

Grading:

Exam I	-	150 pts.	900 +	A
Exam II	-	150 pts.	800 - 899	B or better
Exam III	-	150 pts	700 - 799	C or better
Final Exam	-	250 pts.	600 - 699	D or better
Recitation*	-	<u>300 pts</u>.	< 600	F or better
		1000 pts.		

*Recitation points come from homework, quizzes, and activities. For each of these three categories, the lowest two scores will be dropped.

Exams:

Exam I	-	1.1-1.3, 3.1-3.5, 4.1 (tentative)	Thursday, Oct. 2 (7:30-9:30pm)
Exam II	-	4.2-4.8, 5.1 (tentative)	Thursday, Oct. 30 (7:30-9:30pm)
Exam III	-	5.2-5.6, 2.1-2.3, 6.1 (tentative)	Tuesday, Dec. 2 (7:30-9:30pm)
Final exam	-	Comprehensive	Tuesday, Dec. 16 (8-10am)

<u>**Calculator Policy:**</u> No calculators will be allowed for exams.

<u>**Attendance Policy**</u>: Attendance is required in this class.

Make-up Policy: No make-up exams or late assignments are possible or accepted without a University-approved excused absence (see http://student-rules.tamu.edu/rule07).
- An absence for a non-acute medical service or regular check-up does not constitute an excused absence.
- To be excused, you must notify the instructor in writing (by email is acceptable) prior to the date of absence, if possible. Consistent with Texas A&M Student Rules, in cases where advance notification is not feasible (e.g. accident or emergency) the student must provide notification by the end of the second working day after the absence. This notification must include an explanation of why notice could not be sent prior to the class.
- For injury or illness too severe or contagious to attend class, you must provide confirmation of a visit to a health care professional affirming date and time of visit. The Texas A&M University Explanatory Statement for Absence from Class form will not be accepted. It is the student's responsibility to schedule a make-up in a timely manner.
- This course has regularly scheduled make-up exams. If you are unable to make-up a missed exam at the times listed at http://www.math.tamu.edu/courses/makeupschedulefall2014.pdf, you will need a second university excused absence for all of the listed times for that exam.

Special Services: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637.

Academic Integrity Statement:
Academic dishonesty will not be tolerated.
An Aggie does not lie, cheat, or steal or tolerate those who do.
Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: http://www.tamu.edu/aggiehonor/.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Any student found guilty of cheating, plagiarism, or other dishonorable acts in academic work is subject to disciplinary action. If you are caught cheating, you will receive a grade of "0" and it could result in your failing the course.

Copyright Policy: All printed materials disseminated in class or on the web, including exams, are protected by Copyright laws. Distributing copies or sale of any of these materials is strictly prohibited.

Tentative Week-by-Week Schedule: See http://math/courses/math147/currentsched.html

Catalog Title and Description: (CREDIT 4.0) Calculus I for Biological Sciences - Introduction to differential calculus in a context that emphasizes applications in the biological sciences. Prerequisite: MATH 150 or equivalent or acceptable score on TAMU Math Placement Exam. Credit will not be given for more than one of MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.

Learning Outcomes: This course is focused on quantitative literacy in mathematics with an emphasis on real world applications, especially to the biological sciences. Upon successful completion of this course, students will be able to

- Recognize and construct graphs of basic functions, including polynomials, exponentials, logarithms, and trigonometric functions.
- Construct and interpret semilog and double-log plots used to model biological data.
- Evaluate limits of functions graphically and algebraically.
- Evaluate limits of functions analytically by applying the Sandwich Theorem or LHopitals Rule.
- Understand continuity and be able to justify whether a function is continuous or not using the mathematical definition of continuity.
- Explain the Intermediate Value Theorem and use it to estimate roots of functions.
- Compute derivatives using the limit definition of the derivative.
- Interpret derivatives as rates of change and as the slope of a tangent line.
- Compute derivatives of polynomials and rational, trigonometric, exponential, logarithmic, and inverse functions.
- Apply the product rule, quotient rule, and chain rule to take derivatives of compositions of functions.
- Set up and solve related rates problems.
- Compute the linear approximation of a function and use it in applications of approximation and error estimation.
- Analyze first and second derivatives to determine intervals where a function is increasing or decreasing, concave up or concave down, and to find the locations of local extrema and inflection points.
- Graph complicated functions by analyzing and evaluating the information obtained by differentiation.
- Set up and solve optimization problems.
- Evaluate limits of sequences and recursions.
- Model single-species populations and analyze population models.
- Find fixed points and analyze their stability using the cobwebbing method and the stability criterion.
- Interpret the definite integral as a sum of signed areas.
- Compute definite integrals using Riemann sums.
- Find the antiderivatives of basic functions.
- Compute definite integrals using the Fundamental Theorem of Calculus.
- Apply the substitution method to compute integrals.

Core Objectives
Critical Thinking
- Students will evaluate limits of functions graphically and algebraically.
- Students will evaluate limits of functions analytically by applying the Sandwich Theorem or L'Hopital's Rule.
- Students will justify whether a function is continuous or not using the mathematical definition of continuity.
- Students will compute derivatives using the limit definition of the derivative.
- Students will compute derivatives of polynomials and rational, trigonometric, exponential, logarithmic, and inverse functions.
- Students will use inquiry to determine the best method for taking derivatives of complicated functions.
- Students will apply calculus to find innovative ways to graph complicated functions without the aid of a graphing calculator or computer.
- Students will think creatively about how to accomplish a given optimization objective and apply calculus to achieve this goal.

- Students will compute the linear approximation of a function and use it in applications of approximation and error estimation.
- Students will think creatively about the relationship between two given rates of change and how they affect each other.
- Students will compute limits of sequences and recursions and synthesize the results by explaining the relationship between these limits and the long-term behavior of population growth.
- Students will evaluate and synthesize single-species population data to determine the best mathematical model to represent the population.
- Students will compute definite integrals using Riemann sums.
- Students will find the antiderivatives of basic functions.
- Students will compute definite integrals using the Fundamental Theorem of Calculus.
- Students will apply the substitution method to compute integrals.

Communication Skills
- Students will recognize and construct graphs of basic functions, including polynomials, exponentials, logarithms, and trigonometric functions.
- Students will construct and interpret semilog and double-log plots used to model biological data.
- Students will justify results that require the use of theorems such as the Sandwich Theorem and Intermediate Value Theorem or mathematical definitions such as the definition of continuity by writing mathematical proofs.
- Students will be required to answer questions during lecture concerning topics discussed in class.
- Students will be required to explain verbally in class the connection between derivatives, rates of change, and slopes of tangent lines.
- Students will explain the solutions to related rates problems and optimizations problems in writing.
- Students will develop sketches of the graphs of complicated functions by analyzing the function itself and its first and second derivatives.
- Students will analyze the stability of fixed points by applying the cobwebbing graphical technique.
- Students will interpret definite integrals as sums of signed areas under a graph.

Emirical and Quantitative Skills
- Students will analyze semilog and double-log plots and derive functional relationships associated with such plots.
- Students will analyze population data and determine whether an exponential discrete time model can be used to model the data.
- Students will understand the Intermediate Value Theorem and apply it to locate the roots of functions.
- Students will compute derivatives of functions and use derivatives in applications such as finding equations of tangent lines, computing the linear approximation of a function, solving related rates problems, solving optimization problems, and finding the rate at which a population is growing.
- Students will find the relationship between two given rates of change and make conclusions about how one is affecting the other.
- Students will make conclusions about monotonicity, concavity, extrema, and inflection points of a given function by analyzing the given function and its derivatives.
- Students will manipulate given information to develop a one-variable function to be used in an optimization problem and then apply calculus to find and interpret the optimal solution.
- Students will use antiderivatives and the Fundamental Theorem of Calculus to compute and interpret areas under curves.