MATHEMATICS
TEXAS A&M UNIVERSITY

Math 148 Syllabus

Course number and title	**MATH 148, Calculus II for Biological Sciences**
Term	**Spring 2019**
Class times and location	**Lecture (Sections 501-503):** MWF 10:20am-11:10am in RICH 114 **Lecture (Sections 504-506):** MWF 11:30am-12:20pm in RICH 114 **Recitation for Section 501:** Tues & Thurs 2:20pm-3:10pm in BLOC 120 **Recitation for Section 502:** Tues & Thurs 3:55pm-4:45pm in BLOC 121 **Recitation for Section 503:** Tues & Thurs 5:30pm-6:20pm in BLOC 164 **Recitation for Section 504:** Tues & Thurs 2:20pm-3:10pm in HRBB 224 **Recitation for Section 505:** Tues & Thurs 3:55pm-4:45pm in CHEM 2121 **Recitation for Section 506:** Tues & Thurs 5:30pm-6:20pm in BLOC 161

INSTRUCTOR INFORMATION

Name	**Heather Ramsey**
e-mail address	ramsey@math.tamu.edu
Office hours	Tues 10am-11am in BLOC 241B Wed 2pm-3pm in BLOC 241B Thurs 11am-12pm in BLOC 241B
Help Sessions	Day Time in Room TBD Day Time in Room TBD

COURSE DESCRIPTION AND PREREQUISITES

Title and Description: ***Math 148 Calculus II for Biological Sciences (4 credit hours).*** Introduction to integral calculus in a context that emphasizes applications in the biological sciences; ordinary differential equations and analytical geometry. Credit will not be given for more than one of MATH 148, MATH 152 and MATH 172.

Prerequisite: MATH 147 or approval of instructor.

LEARNING OBJECTIVES

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:

- apply techniques for integration, including integration by parts and partial fraction decomposition.
- identify and compute improper integrals using limits.
- justify why an improper integral converges or diverges by applying the comparison theorem.
- approximate functions with Taylor polynomials and evaluate the error in the approximation by using the Taylor inequality.
- solve separable ordinary differential equations.
- understand how exponential population growth is modeled by a constant per capita growth rate while logistic population growth incorporates density dependence.
- find equilibria of differential equations and analyze their stability both graphically and by using the stability criterion.
- apply various techniques for solving systems of equations, including Gaussian elimination.
- apply basic matrix algebra skills including addition, subtraction, scalar multiplication, and multiplication of matrices and find the inverse of a matrix and be able to use matrix algebra to solve problems.
- compute and interpret eigenvalues and eigenvectors for 2×2 matrices.

- use matrices in biological applications, including the study of age-structured populations.
- interpret 2 × 2 linear maps applied to 2 × 1 vectors.
- add, subtract, and scale vectors and compute dot products.
- use vectors in applications, including finding equations of lines and planes.
- understand concepts of limits and continuity for multivariable functions.
- use partial derivatives and linear approximations for solving real-world problems.
- understand and explain the concepts of equilibria and stability for biological systems of difference equations.
- correctly solve applied problems and write the solutions in a coherent fashion.
- construct and analyze linear and nonlinear systems of differential equations applied in biology and medicine.

Core Objectives

Critical Thinking

The following critical thinking skills will be assessed on exams and other assignments. Students will:

- Analyze integrals and determine the proper technique for integration, including the integration by parts and partial fraction decomposition methods.
- Identify and compute improper integrals using limits.
- Approximate functions with Taylor polynomials and evaluate the error in the approximation by using the Taylor inequality.
- Solve separable ordinary differential equations.
- Find equilibria of differential equations and analyze their stability both graphically and by using the stability criterion.
- Apply techniques for solving systems of equations, including Gaussian elimination.
- Learn basic matrix algebra skills including addition, subtraction, scalar multiplication, and multiplication of matrices and be able to find the inverse of a matrix.
- Creatively apply matrix algebra to solve systems of equations.
- Compute and interpret eigenvalues and eigenvectors for 2 × 2 matrices.
- Understand and apply concepts of limits and continuity for multivariable functions.
- Compute partial derivatives and linear approximations to solve real-world problems.
- Compute equilibria and analyze their stability for biological systems of difference equations.
- Solve applied problems and write the solutions in a coherent fashion.
- Analyze and construct linear and nonlinear systems of differential equations applied in biology and medicine.

Communication Skills

The following communication skills will be assessed on exams, during lecture, and on other assignments. Students will:

- Justify why an improper integral converges or diverges by applying the comparison theorem.
- Understand how exponential population growth is modeled by a constant per capita growth rate while logistic population growth incorporates density dependence.
- Find equilibria of differential equations and analyze their stability both graphically and by using the stability criterion.
- Apply basic matrix algebra skills including addition, subtraction, scalar multiplication, and multiplication of matrices and finding the inverse of a matrix to solving problems.
- Interpret the action of 2 × 2 linear maps applied to 2 × 1 vectors both graphically and numerically.
- Add, subtract, and scale vectors and compute dot products.
- Use vectors in applications, including finding equations of lines and planes.
- Solve applied problems and write the solutions in a coherent fashion.
- Construct and analyze linear and nonlinear systems of differential equations applied in biology and medicine.

Empirical and Quantitative Skills

The following empirical and quantitative skills will be assessed on exams and other assignments. Students will:

- Apply techniques for integration, including integration by parts and partial fraction decomposition.
- Solve separable ordinary differential equations.
- Find equilibria of differential equations and analyze their stability both graphically and by using the stability criterion.

- Compute and interpret eigenvalues and eigenvectors for 2 × 2 matrices.
- Compute the Leslie matrix associated with a given data set pertaining to an age-structured population and use it to make predictions of population sizes for future generations.
- Use partial derivatives and linear approximations for solving real-world problems.
- Compute equilibria and analyze their stability for biological systems of difference equations.
- Manipulate given information to construct and analyze linear and nonlinear systems of differential equations applied in biology and medicine.

TEXTBOOK AND OTHER REQUIRED MATERIALS

- *Calculus for Biology and Medicine*, Fourth Edition, by Claudia Neuhauser and Marcus Roper, Pearson 2017, ISBN-13: 978-0-13-412259-5
- Four gray TAMU Scantrons (8.5 in by 11 in)
- Printed copy of each chapter of lecture notes, available in eCampus, brought to all class meetings
- *Optional:* A four-function calculator, such as the Sharp EL233SB Pocket Calculator
- *Optional:* A folder to organize your lecture notes and a notebook in which to work the suggested homework problems

CALCULATOR POLICY

The only calculator that will be allowed in this course is a four-function calculator, such as the Sharp EL233SB Pocket Calculator. Graphing calculators and scientific calculators will not be allowed. A four-function calculator may be used on all recitation assignments, quizzes, and exams.

GRADING POLICIES

The course grading will be based on the results of three midterm exams, weekly recitation assignments and quizzes, and a comprehensive final exam.

- **Midterm Exams:** Each midterm exam will consist of two parts: multiple choice (no partial credit) and work out (partial credit possible). The multiple choice part of the exam will be administered during recitation sessions, and 50 minutes will be given. The work out part of the exam will be administered during lecture, and 50 minutes will be given. Both parts of each exam are closed book. Students are not allowed to use notes, formula sheets, books, or electronic devices, with one exception–an approved 4-function calculator may be used for all parts of all exams. The Sharp EL233SB Pocket Calculator is an example of an approved 4-function calculator that can be purchased for less than $4 at Wal-Mart. Students need to bring a No. 2 pencil and their TAMU student ID to each part of each exam. Students will also be asked to provide 4 gray TAMU Scantrons during the first week of classes.

- **Recitation Assignments:** A set of problems will be assigned during recitation each Tuesday and will be due during that class period. Students may work on these problems in groups of up to three. These assignments will be graded on a 10-point scale, and no make-up assignments will be given without written verification of a University excused absence. **Contact your TA with verification that your absence is University excused and to schedule a make-up assignment.**

    - **TA for Sections 501-503:** Arpan Pal, arpantamu@tamu.edu

    - **TA for Sections 504-506:** Vivian Deng, vivian.deng@math.tamu.edu

- **Quizzes:** Announced and unannounced quizzes and will be given throughout the semester during Thursday recitations and possibly during MWF lecture. Each quiz will be graded on a 10-point scale, and no make-up quizzes will be given without written verification of a University excused absence. One quiz grade will be dropped. **Contact your TA with verification that your absence is University excused and to schedule a make-up quiz (see above for email addresses).**

- **Homework Assignments:** Homework assignments will be posted on the course website. These assignments will not be collected for a grade, but completing them is essential to doing well in the course. I will assume that all students have worked all problems, so all material covered in the homework assignments is fair game for all exams and quizzes.

- **Final Exam:** The final will be a comprehensive, all multiple choice exam. No partial credit will be given. Note that the score earned on the final exam can be used to replace the lowest of the first three midterm exam grades if the final exam score is higher than this lowest score. At most one grade replacement will be made, and the final exam grade cannot be dropped (meaning the final is **required** for all students). Exam grades associated with acts of academic dishonesty cannot be replaced by the final exam score.

- **Course Timeline and Percentages**

Activity	*Date*	*Weight*
Exam I	Feb. 14 and 15	18%
Exam II	Mar. 21 and 22	18%
Exam III*	Apr. 17 and 18	18%
Recitation Assignments	Weekly	10%
Quizzes	Weekly	13%
Final Exam	501-503: May 6, 8-10am 504-506: May 7, 10:30am-12:30pm	23%
TOTAL		100%

*Due to the reading day on Friday, April 19, Exam 3 will be on a Wednesday and Thursday.

- **Grading Scale**

Range	Grade
90% ≤ Course Average	A
80% ≤ Course Average < 90%	B
70% ≤ Course Average < 80%	C
60% ≤ Course Average < 70%	D
Course Average < 60%	F

- **Excused absences**: Attendance is mandatory and may affect your grade. For excused absences we refer the student to Student Rule 7 at http://studentrules.tamu.edu/rule7.htm. Excuses for absences during an exam must be substantiated by appropriate documentation. No make-up recitation assignments, quizzes, or exams will be given without an official, written, University Excuse. Falsification of documentation is a violation of the Aggie Honor Code.

  You must notify me (ramsey@math.tamu.edu) for exams or your TA for recitation assignments and quizzes in advance to ensure the right to a make-up. If advance notice is not possible (i.e. sudden illness), you MUST contact me or your TA, as appropriate, within TWO working days of the missed exam/assignment/quiz; otherwise, you forfeit the right to a make-up.

  An absence for a non-acute medical service or regular check-up does not constitute an excused absence. Please note that I will NOT accept the Explanatory Statement for Absence from Class form as sufficient written documentation of an excused absence.

  - **Missed Recitation Assignments and Quizzes:** Your teaching assistant will coordinate with you for making up a recitation assignment or quiz.

    - **TA for Sections 501-503:** Arpan Pal, arpantamu@tamu.edu

    - **TA for Sections 504-506:** Vivian Deng, vivian.deng@math.tamu.edu

  - **Missed Exams:** If you have a University approved absence for missing an exam, you will be expected to make up your exam according to the Math Department's Make-up Schedule that can be found at

    http://www.math.tamu.edu/courses/makeupexams.html

starting with the first option for each exam. Only if you have a University approved absence for the day of the exam and the previous makeup day will you be allowed to use the later options or have other arrangements made. You must discuss (email is fine) the need for a make-up exam with me before going to a scheduled time.

AMERICANS WITH DISABILITIES ACT (ADA)

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 Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu/

ACADEMIC INTEGRITY

For additional information please visit: http://aggiehonor.tamu.edu

"An Aggie does not lie, cheat, or steal, or tolerate those who do."

In this course students can discuss homework assignments and solutions. However, it is NOT permissible to copy homework solutions from another student. It is NOT permissible to discuss any aspect of any test or examination until ALL students have completed the exam. The penalties for violating this policy will range from an F on an assignment or test, to failing in the course.

You are encouraged to work together on the homework assignments, but do not copy another student's work. Copying work done by others, either in class or out of class, is an act of scholastic dishonesty and will be prosecuted to the full extent allowed by University policy.

During recitation, you will be allowed to work in groups of up to three students. **All group members are expected to contribute to the assignment.** If the teaching assistant finds that one or more members of a group are not participating, and if this is a first offence, then all members of the group will be asked to work individually for the rest of the period and submit individual assignments. If this happens on a subsequent assignment, ALL members of the group will be submitted to the Aggie Honor Office for scholastic dishonesty. For example, if the name of a student who was absent appears on that day's recitation assignment, ALL students in that group will receive a 0 on the assignment and be reported to the Aggie Honor Office.

Using an unauthorized calculator during an exam or quiz will result in a zero on the assignment. Also, cell phone use during an exam, quiz, or recitation assignment will result in a zero on the assignment. These violations of the Aggie Honor Code will be reported.

Always abide by the Aggie Code of Honor: *An Aggie does not lie, cheat, or steal or tolerate those who do.* Please refer to Honor Council Rules and Procedures at http://www.tamu.edu/aggiehonor for more information on academic integrity and scholastic dishonesty. I have served as a member of the Aggie Honor Council, so I take these matters very seriously.

EXTRA HELP AND PREPARING FOR EXAMS

- **Your Instructor:** I want each and every one of my students to be successful in this class. Please feel free to ask questions in class. If you need more help, come by my office during office hours or make an appointment to see me. Remember, I am here to help, but I cannot do that if I don't know that there is a problem.

- **Recitation and TA:** You will attend recitation with a teaching assistant twice per week. During these class periods, you will be able to ask the TA to explain homework problems and review any topics from lecture, so be sure to take advantage of this class time.

- **Your Classmates:** Get to know your classmates. Form study groups and work on homework problems outside of class.

- **Practice:** Working ALL of the homework problems from your textbook is essential to doing well in this course. If you struggle with these problems the first time you work them, be sure to work them again AND work other problems from the textbook that are similar. I strongly recommend that you practice problems DAILY.

- **Dr. Glenn Lahodny's Math 148 Web Page:** Dr. Lahodny has very generously offered his course materials for our use. He has practice problems for each exam, along with blank copies of his lecture notes, posted at http://www.math.tamu.edu/~glahodny/Math148/Fall2018/

- **Free Tutoring!!! (a.k.a. Help Sessions):** Help sessions are an opportunity for you to ask questions and get help with your homework. The schedule for fall help sessions can be found on my webpage. These sessions are come-and-go, i.e., you can come at any point during the help session and leave whenever you want.

OTHER CLASS POLICIES

- **Email Policy:** Check your TAMU email account and eCampus EVERY day. You are responsible for any information I post in eCampus and send through email. If you send an email to me, be sure to include your full name, "Math 148," and section number in the message. NOTE: Because of privacy rights, I cannot discuss grades via email or over the phone.

- **Cell Phone/Laptop Computer Policy:** As a courtesy to me and your classmates, and to improve student participation and reduce distractions, all cell phones and laptop computers (unless they can be laid flat in tablet mode and are being used for notetaking) must be OFF and put away during lecture. If you disrupt class or distract your neighbor or distract me with your cell phone or other electronic device, you may be asked to leave class.

COURSE TOPICS (Tentative weekly schedule)

WEEK	TOPIC	REQUIRED READING
1	Integration by Parts, Partial Fractions	Sections: 7.2, 7.3
2	Partial Fractions, Improper Integrals, Taylor Approximation	Sections: 7.3, 7.4, 7.6
3	Taylor Approximation, Solving Differential Equations	Sections: 7.6, 8.1
4	Equilibria and Their Stability, Applications	Sections: 8.2, 8.3
5	Linear Systems, Matrices **Exam 1** (Covering 7.2–7.4, 7.6, 8.1-8.3)	Sections: 9.1, 9.2
6	Linear Maps, Eigenvalues, Eigenvectors, the Leslie Matrix	Sections: 9.3, 9.4
7	Analytic Geometry, Functions of Several Variables, Limits and Continuity	Sections: 9.5.1, 9.5.2, 10.1, 10.2
8	Limits and Continuity for Functions of Several Variables, Partial Derivatives	Sections: 10.2, 10.3
9	Tangent Planes, Differentiability, Linearization **Exam 2** (Covering Sections 9.1–9.5, 10.1-10.3)	Sections: 10.4
10	Chain Rule for Functions of Two Variables, Maxima and Minima	Sections: 10.5.1, 10.7.1
11	Maxima and Minima, the Hessian Matrix, Systems of Recurrence Equations	Sections: 10.7.1, 10.9
12	Homogeneous Linear First-order Systems of Differential Equations, Applications	Sections: 11.1, 11.2
13	Nonlinear Autonomous Systems **Exam 3** (Covering Sections 10.4, 10.5, 10.7, 10.9, 11.1, 11.2)	Sections: 11.3
14	Lotka-Volterra Model for Interspecific Interactions	Sections: 11.4
15	Catch up and Review	