Syllabus for MATH 124 – Calculus for the Life Sciences (Spring 2018)

BASIC INFORMATION
Instructor: Dr. Antoni Luque (http://www.luquelab.com)
TA: James Mullinix (http://www.luquelab.com/team.html)
Lectures: Monday and Wednesdays: 4:00 pm—5:15 pm, GMCS-333
Lab: Fridays, GMCS-421, 2 hours 40 minutes, three sections (8am, 11am, 2pm)
Office Hours: In class 15 minutes before and after every lecture. Personal issues can be addressed by email or scheduling a phone call or an appointment.
E-mail aluque@mail.sdsu.edu

Important dates
First lecture Wednesday, January 17
ALEKS placement deadline Thursday, January 25
Last day to drop the course Tuesday, January 30
Knowledge Survey 1 Wednesday, January 31
C-test 1 Monday, February 19
Problem set 1 Monday, February 26
Knowledge Survey 2 Monday, March 12
C-test 2 Monday, March 19
Problem set 2 Monday, April 2
C-test 3 Monday, April 23
Problem set 3 Monday, April 30
Knowledge Survey 3 Wednesday, May 2
Last lecture / Course reflection Wednesday, May 2
Remedial test Monday, May 7 (3:30 pm – 5:30 pm)

An agenda with all the activities associated to each class and lab session is available on Blackboard.

Course background. Calculus for the Life Sciences (MATH 124) is a 4-unit requisite course (grade C or higher) for students in Biology, Microbiology, Environmental Sciences, Geography, and Economics majors. The course introduces calculus methodologies commonly used in applications on these disciplines, and it includes a 1-unit credit laboratory. The course design relies on cognitive science principles and math education research to facilitate the development of effective self-learning strategies and growth mindset. Student feedback is a key factor to improve the course, and student opinions and comments will be collected informally and in surveys throughout the course.

Topics covered
Functions Linear, quadratic, power law, exponential, logarithmic, trigonometric, rational
Models Linear regression, exponential and logistic growth, power law, Michaelis-Menten
Limits Continuous function, asymptotic limits
Derivatives Slope, optimization, rates, differential equations
Integrals Indefinite integrals, differential equations, initial conditions, definite integrals, areas, continuous random variables, probability

The instructor reserves the right to make modifications to the syllabus. Any addendum will be announced in class and Blackboard.
The lecture notes are available on Blackboard.

**Prerequisites.** Students may place into Math 124 by getting a C or better in Math 141, getting a 3 or better on the AP BC test, or scoring 72 or better on the ALEKS placement. To remain in the course, all students will be required to score a 72 or better in the ALEKS placement at the beginning of the course.

**Student success.** MATH 124 is a challenging course with a high percentage of students receiving less than a C: 62.5% (Fall 2014), 53.2% (Spring 2015), 62.5% (Fall 2015), and 50.9% (Spring 2016). Last semester (Fall 2017), MATH 124 was redesigned to offer students more opportunities to develop the mathematical skills required to pass the course. In this second semester of the redesign, we have improved the organization of the course to improve student learning and student success.

**Workload.** The course activities are designed having in mind the standard workload expected in the College of Sciences: 2 hours of study per unit credit per week. An average student is expected to work 8 hours per week on this course besides class time. This, however, can vary depending on the student mathematical foundations and strategies of study.

**Attendance.** Attendance may be recorded for statistical purposes to measure the impact of course structure in student engagement. Missing class is not penalized, but it may have an indirect negative effect in the team-peer evaluation and in the development of your skills.

**Rescheduling.** Assigned activities must be completed by the due date. Rescheduling will be possible only in compelling and verifiable circumstances, and students should communicate the need for any special arrangement as soon as possible in the course.

**Students with disabilities.** If you are a student with a disability and believe you will need accommodations for this class, contact Student Disability Services at (619) 594-6473 as soon as possible. Your cooperation is appreciated.

**Team-Based Learning.** Students will form permanent teams of 4 to 6 students to work in class and lab activities. The course pedagogy uses principles from Team-Based Learning to foster an engaging and productive environment that facilitates the development of good teamwork behaviors and math skills. Each team will evaluate the contribution of the team members using the Teamwork VALUE Rubric (available on Blackboard).

**Ground rules.** These rules are key to develop a healthy and productive environment in the class and team activities:

1. Arrive on time.
2. Do not leave the class early without checking with the instructor and your team.
3. Listen actively and attentively.
4. Ask for clarification if you are confused.
5. Do not interrupt one another.
6. Challenge one another, but do so respectfully.
7. Critique ideas, not people.
8. Do not offer opinions without supporting evidence.
9. Avoid put-downs (even humorous ones).
10. Take responsibility for the quality of the discussion.
11. Build on one another’s comments; work toward shared understanding.
13. Do not monopolize discussion.
14. Speak from your own experience, without generalizing.
15. If your are offended by anything said during discussion, acknowledge it immediately.
16. Consider anything that is said in class strictly confidential.

**Evidenced-based approach.** The organization of the course and the activities are based on extensive research about effective learning. Every year we revise students evaluation, new research findings, and new technologies to keep improving the course. Your feedback plays a crucial role in this process. We greatly appreciate your collaboration.

**Academic dishonesty.** Institutions of higher education are founded to impart knowledge, seek truth, and encourage one’s development for the good of society. University students are intellectually and morally obliged to pursue their course of studies with honesty and integrity. Cheating and plagiarism will result in a F grade. An Academic Dishonesty Report Form will be also processed through the Center for Student Rights and Responsibilities (CSRR), [link](#). The offender(s) may be expelled, suspended, placed on probation, or given a lesser sanction as established in Section 41301 of Title 5, California Code of Regulations.

**GRADING and LEARNING OUTCOMES**

Course grades are aligned with specific learning outcomes following the specifications grading pedagogy (Nilson, 2014). Graded activities are evaluated using a quality baseline, and there is no partial credit, that is, either an activity meets the quality standards or it does not. The Knowledge Survey lists the ideal set of skills and abilities to be developed in the course and is used as a periodic instrument for student self-assessment.

Main learning outcomes

- Analyze data combining basic statistics and linear regression methods using linear and non-linear mathematical models that are common in life sciences.
- Interpret visually the instantaneous rate of change of common functions in life sciences and derive mathematically the main properties of derivatives.
- Apply the properties of derivatives to study generic functions and solve rate and optimization problems.
- Interpret visually the definite and indefinite integrals of a function and derive mathematically the main properties of integrals.
- Apply the properties of integrals to solve differential equations associated to rate problems as well as obtaining statistical properties of common probability distributions in life sciences.
- Investigate a real problem with a team combining the skills listed above.

**Grade Requirements**

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<tr>
<th>Grade</th>
<th>Requirements</th>
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<tbody>
<tr>
<td>F</td>
<td>Failing any requirement in the D level.</td>
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<tr>
<td>D</td>
<td>Complete satisfactorily 50% to 79% of each C-test.</td>
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<tr>
<td>C</td>
<td>Complete satisfactorily at least 80% of each C-test. Complete satisfactorily at least 80% of the C-level take-home problems. Reach at least the level 2 for each teamwork skill. Complete the team-project satisfactorily. C-: Completing 40% to 79% of the C-level problems. C+: Completing 10% to 39% of the B-level problems.</td>
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<tr>
<td>B</td>
<td>Requirements for C. Complete satisfactorily at least 80% of the B-level take-home problems.</td>
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B-: Completing 40% to 79% of the B-level problems.
B+: Completing 10% to 39% of the A-level problems.

A Requirements for C and B.
Complete satisfactorily at least 80% of the A-level take-home problems.
A-: Completing 40% to 79% of the A-level problems.

+ Having completed satisfactorily problems in a level higher than the final grade.
– Not completing the requested course surveys, e.g., Knowledge Survey.

Not developing the appropriate teamwork skills will reduce one grade level.
Not completing the team-project satisfactorily will reduce one grade level to each team member.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Learning outcomes</th>
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<tbody>
<tr>
<td>F</td>
<td>No learning outcomes achieved</td>
</tr>
<tr>
<td>D</td>
<td>The student can recall the mathematical definitions of the calculus methods covered in the course, interpret these methods visually, and use them in direct calculations at a 50 to 79% success rate.</td>
</tr>
<tr>
<td>C</td>
<td>The student can recall the mathematical definitions of the calculus methods covered in the course, interpret these methods visually, and use them in direct calculations at a 80% or higher success rate. The student can mathematically derive relevant formulas covered in the course and analyze problems that resemble basic examples discussed in class. The student has developed good teamwork skills: He/she contributes to team meetings, facilitates contributions of team members, contributes individually outside team meetings, fosters constructive team climate, and responds to conflict constructively. In collaboration with a team, the student can complete satisfactorily a team-project that analyzes and models a real problem using calculus techniques.</td>
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<tr>
<td>B</td>
<td>Learning outcomes in C. The student can also use the methods covered in the course to solve applied problems in social and biological contexts when the questions are well framed mathematically and the information is analogous to challenging problems discussed in class or addressed in activities.</td>
</tr>
<tr>
<td>A</td>
<td>Learning outcomes in C and B. The student can also seek information and resources to learn new mathematical methods and solve problems that may not be analogous to those addressed in the course.</td>
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**MATERIALS and TOOLS**

**Textbook.** The course is not based on any textbook, but the lecture notes are accessible online in Blackboard.

**Google Docs.** Each Team will use Google Docs to work on the Team-Project.
**Google Sheets/Excel.** Google Sheets or Excel will be used as the standard platforms to analyze data and generate figures for the Team-Project.

**Desmos.** This online graphing calculator ([https://www.desmos.com/about](https://www.desmos.com/about)) will be used to plot and study functions.

**Wolfram Alpha.** We encourage the use of this online computing engine to validate answers and explore new problems.

**Khan Academy.** This online site offers short lectures and online exercises on topics covered in this course: [https://www.khanacademy.org/math](https://www.khanacademy.org/math). It is an excellent complement to reinforce the activities in the course.

**Paul's Online Math Notes.** The website [http://tutorial.math.lamar.edu/](http://tutorial.math.lamar.edu/) is a great resource for pdf format textbooks, which cover from algebra through trigonometry, calculus, and differential equations. The website also contains problem sets with worked solutions for all these areas of math.

**ACTIVITIES**

**Team-Project:** The goal of the Lab will be to reinforce the methodologies learned in class to help students develop a project in teams that analyzes and models data to study a real problem. Each team will prepare a manuscript in Google Docs, and the instructor and TA will serve as editors. Team members will evaluate each other using the Teamwork VALUE Rubric (available on Blackboard).

**Aligned activities.** The lecture examples, quiz activities, problem sets, and team-project are aligned with the Knowledge Survey items to facilitate the development of specific student skills.