General Course Information

Calculus II – MATH 115
Spring 2016

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Class: RB 412 (MWF) 11:30am-12:30 pm
Lab: RB 424 Tuesday and Thursday 1:00-2:20 pm

Course Description
Calculus provides the basic mathematical language for modern science, and increasingly so in recent years for the life sciences. Calculus studies how quantities often seem to depend on one another in nature via the notion of function. Beyond its ubiquity in modeling nature, calculus exhibits how a few simple ideas can be leveraged over and over again to solve many different problems and is a first example of a coherent body of mathematical knowledge showcasing the use of simplicity to tame complexity. Calculus is, in a nutshell, about the relation between (distance)=(rate) x (time) and (rate)=(distance)/(time) when combined with the idea of limit. Conceptually, the core ideas of the course could be explained in one hour but the main goal of the course is to learn a way of thinking about problems by building from the simple to the complex, and by internalizing and applying the “language” of mathematics fluently to solve problems like a mathematician. We will emphasize significant connections with examples from the Biological Sciences. At the end of this course, after working very hard, you will hopefully know which mental tools to reach for when faced with a problem that can be modeled using the concepts from Calculus (which fortunately are found a lot of places in the scientific literature).

Often students ask “Why should I learn all of these integrals and derivatives when a calculator can automatically do them?” This is a valid question. The short reason is this: to effectively think about something, it has to be accessible to your working memory. Problems are solved by your subconscious mixing together the things you’ve stored in your head. If it isn’t in your head, it won’t get used to build the solution to a problem! In a bit more detail, mathematicians compute in order to see patterns and to gain intuition for what is really going on in a problem. These intuitions, once gained, allow one to imagine one’s way to the end of a problem reasonably accurately. The point of learning all of these mental habits and ways to compute is to be able to make sharper thought experiments. When you are practicing the basics, you are also slowly
gaining an increased ability to guess and predict what will happen if you carry out a computation. This approach to scientific problem solving (working on clear mechanical procedure in order to visualize and predict) is very effective and is easiest to exemplify in mathematics because of the clarity and precision of mathematical language. Later, hopefully, the habits you gain here will allow you to better organize and predict other systems evolving from basic “rules”, like a chemical reaction, or a metabolic cycle in a cell, or a computer program. Of course, one may argue that doing the above things on their own could yield the same facility as doing mathematics, but remember that mathematics, especially calculus, is used as the basic language of science. Studying this material is “walking before you can run”.

Three hours of lecture and one hour and twenty minutes of laboratory each week. Lab fee: Students must purchase an approved graphing calculator prior to beginning this course.

Course Set-Up

The following is the simple format of the course:

M,W,F Class: Either lecture or active problem solving, discussion or writing activity like one of the following:

1) Inquiry-Based-Learning module or group activity
2) Stand-up Calculus exercise
3) Concept tests/ Classroom voting: I’ll ask you to solve tough conceptual questions that test your understanding of the reading. You’ll talk the solutions over with your neighbor.

4) Problem Climb: We begin with the most basic example of the day’s concept and make it more and more complicated.
5) Student Lecture Opportunities (SLOs): You can give a short presentation on a topic or can lead a discussion…for credit!

T,R Lab: Presentation of problems to me individually for credit.

Note: It is prudent to stay on top of the work in Calculus, so you have to make sure to do something every day!

Learning Goals

This course most directly addresses Siena learning goals 1,2,3 and 5. We see goal 1 because mathematics in general is concerned with clear and logical reasoning, which is the cornerstone of measured judgement. We observe goal 2 because of the necessity of students clearly presenting their findings in language, although rhetoric here isn’t quite the point but clarity and economy of language which is separate from logic. We treat goal 3 because of the architecture of our course requires the humane help of each other through the difficulties of learning a hard subject; Calculus brings many students to the edge of their learning ability, leading to careful reflection on how we learn about and understand our world. Finally, we observe goal 5 because Calculus
finds itself at the root of almost all change in nature as observed by science.

Regarding the learning goals of the School of Science, this course most directly deals with goals A and C found here. We include goal A, since application of method and problem solving are essential to the course, and goal C because of our emphasis on presentation of solutions.

Regarding the learning objectives of the Mathematics Department, this course most directly speaks to objectives 2, 3 and 4 found here. We include objective 2 because Calculus is the heart of every undergraduate mathematics curriculum, Siena’s in particular. We include objective 3 because of the emphasis on presentation of solutions. We include objective 4 because a large fraction of the material in the course is concerned with applications of the ideas of Calculus through the application of mathematical models.

Course Goals: After successfully completing this course, a student will be able to:

1) Adeptly use derivatives, limits and definite and indefinite integrals to solve mathematical problems, sometimes involving ordinary differential equations.
2) Use the Fundamental Theorem of Calculus to evaluate definite integrals and to define functions.
3) Use the various techniques of differentiation, including the product rule, quotient rule and chain rule, and the substitution rule for integrals.
4) In each of the 3 above, the student will be able to clearly present their solutions and ideas in writing and orally, and will be able to discuss and answer questions about their work.
5) Work with Eigenvalues and Eigenvectors to Solve systems of differential equations.

Course Materials

The textbook for this course is Calculus for the Life Sciences by Sebastian Schreiber, Karl Smith and Wayne Getz. ISBN-13: 978-1118180662
ISBN-10: 1118180666

Means of Assessment

In this course there will be four primary means of assessment.

1. Lab (Homework Problem Presentation) (210 course points) Each lab period, you will be awarded 10 course points for attendance. (I will take attendance.) We will work together on problems and concepts in the lab.
2. Exam 1 (180 course points): This first in-class exam will be concerned with course goals (1), (2) and (5) above, and will test if students can work with the four ways to define a function, can perform basic operations on functions, can use the basic properties of limits and can work with the derivative at a point. Emphasis on clarity of the solution is given, not just getting “the right answer”, hence goal (5) is assessed through the student’s written solutions.
3. Exam 2 (180 course points): This second in-class exam will involve goals (1), (2), (3)
and (5). This exam will assess student proficiency with the derivative of a function and applications of this idea to related rates and optimization. We assess goal (5) in the same way as above.

4. **Exam 3 (180 course points):** The third in-class exam will be on integrals and their applications and will involve goals (1)-(3) and (5) again, with a heavy emphasis on specific classes of applications that fall under (1), since the applications are all special cases of the idea of definite integral. In particular, the computation of areas, volumes and work. Depending on time, this exam may involve some of (4)

5. **Final Exam (250 course points):** The final will be a cumulative exam, and will more completely assess (4), although mostly elementary ideas from (4) are usually sufficient.

In summary, your final grade will be computed as your total out of 1000 points. Your midterm course grade will be reported as a running average based on your quiz grades and grade on Exam 1:

- Lab: ......................(210 points) 21%
- Exam 1: .............(180 points) 18%
- Exam 2: ..............(180 points) 18%
- Exam 3: ..............(180 points) 18%
- Final Exam: ...........(250 points) 25%

I will use the standard grade scale, i.e. A=90-100, B=80-89, C=70-79, D=60-69, F<60, with +/-grades being assigned at my discretion.

**Expectations**

1) You are expected to treat others with respect.

2) You are expected to participate. You can’t just abstain from (1)

3) You are expected to come to class prepared. In this course there will be some assignments that will require your to work out of class.

The thoughtful and sensitive critique and support you provide for your classmates is an important part of our learning experience.

**Teaching Approach**
My philosophy for this course is summarized as follows: Learning Calculus is like learning to ride a bicycle, you have a little push to get started but then you simply have to practice. You can no more learn Calculus from watching me solve problems and not doing homework than you can learn to ride a bike by watching a movie of someone riding a bike and never trying to ride one yourself. For this reason, I try to keep lecturing short, simple and clear and then get on to doing problems together.

Exam Schedule

There will be three in-class exams: Exam 1 is on 9/21, Exam 2 is on 10/21 and Exam 3 is on 11/23. The time and location of the final are TBA, but closer to finals time will be available via the Siena webpage.

Academic Integrity Policy

If you cheat, it will be reported. The Siena Committee on Academic Integrity hears cases of alleged academic dishonesty. This student/faculty committee reviews evidence for and against the accused. If the student is found guilty, the committee will determine the appropriate sanction(s), which may include failure of the course, suspension from the College, or permanent dismissal. A statement of the reasons for such sanctions will be placed in the student’s file. Alleging ignorance of what constitutes academic dishonesty or of the College’s policy on the subject will not be considered a valid explanation or excuse.

Accomodations Policy

Students with disabilities must register with the Office of Services of Students with Disabilities: http://www.siena.edu/pages/2759.asp. Once registered, accommodations will be made via communication of the above office with the instructor.

Emergency Policy

In the event of an emergency, see http://www.siena.edu/pages/2887.asp, class will be cancelled, and further instruction will be given by e-mail from the instructor to students, determining the course of action. If possible, the class will carry on virtually via online assignments and readings. In more detail:

(a) You are instructed to bring all texts and a copy of the syllabus/course schedule home with you in the event of a College Closure. The Academic Calendar will be adjusted upon Reopening; so be prepared for the possibility of a short mini-semester; rescheduled class/exam period; and /or rescheduling of the semester, depending on the length of the Closure.

(b) If your situation permits, you should continue with readings and assignments to the best of your ability, per the course schedule.
(c) You will be given instructions regarding how to deal with paper assignments requiring library or other required research by me, as needed.

(d) Online office hours will be used by me in order to maintain contact with my students. You will be able to "check-in" with questions that you have. If you do not have internet access available, I will also provide my home phone number and home address, as needed. Remember, internet, mail delivery, and telephone services may also be impacted by a Pandemic or other emergency event.

(e) Finally, stay connected with information regarding the status of the College's status and Reopening schedule by monitoring the Siena

**Attendance Policy**

Attendance is mandatory in this course. However, documented absences don’t count as absences in this course. A documented absence is: an absence I have excused, a documented illness, a documented athletic department trip, a documented field trip for another course, or a documented family emergency.