Fall 9-1-2000

MATH 150.04: Applied Calculus

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Information Sheet: Math 150 Applied Calculus, Fall 2000

Catalog Description: Prereq. Math 121, or appropriate score on placement exam. Introductory course surveying the principal ideas of differential and integral calculus with emphasis on computer software. Mathematical modeling in discrete and continuous settings. Intended primarily for students who do not plan to take higher calculus.

Goal: The purpose of this class is to introduce you to describing change mathematically. In this context we will meet with derivatives, integrals, and both difference and differential equations. We approach these concepts as tools for making mathematical models. In this context we will use computer programs for exploring models and to do some of the algebraic manipulation. Most examples will be drawn from the sciences, particularly the life sciences.

Coordinator: Greg St. George Office: Math 205a Phone: 243-4146 e-mail: stgeorge@selway

This is the person you should see, initially, if you have questions, complaints, etc., regarding this course. You should feel free to contact him and to talk with about any of your concerns relevant to this class.

Text: Applied Calculus, by Greg St. George. Faculty Pack.

Important Dates:

25 Sept. Last Day to Add/Drop using Dial-a-Bear. Last day to Pay Fees. Last day to receive full refund for drops.

16 Oct. Last day to drop using drop/add form. After this drops will appear on transcript (WP or WF) and a fee will be assessed. Last day to change grading options.

7 Nov. Election Day (No Class)

10 Nov. Veteran's Day (No Class)

22-24 Nov. Thanksgiving Vacation

Schedule: A (very) approximate schedule is the following:

Review and Data Fitting 1-2 weeks. Difference Equations: 1-2 weeks. Differentiation: $\sim$ 4 weeks. Integration: $\sim$ 3 weeks. Differential Equations: $\sim$ 2 weeks.

The fac pack does some differential equations before integration; this order may or may not be followed in your section.

Grading: This will be the responsibility of the teachers of the various sections. Usually it is based on a combination of problem sets, computer assignments and tests. Finals will given Dec. 18–21 in your usual classroom according to the scheme outlined on page 13 of the Class Schedule. Do not make a plane reservation before checking this schedule.

Software and Calculators: You will need a scientific calculator for this class, and some sections will require a graphing calculator. We will be learning to use Microsoft Excel and Maple (Waterloo-Maple Software). Both of these programs are available in both the labs in the Mathematics building and in the CIS labs on campus. You do not need to purchase either of these products.

On reserve: In the reserve book room of the library there is a copy of the faculty pack. There are also two supplementary books:

F. Adler, *Modeling the Dynamics of Life.* Covers much of the same material as fac pack.

Richard F. Burton, *Biology by the Numbers.* A good book but mostly relevant to chapter 1.

Important Note: You should not be in this class if you are majoring in Mathematics, Chemistry, Physics, Computer Science or any other major which requires Math 152-153.

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❑ Instructions and Rules for Written Mini-Projects:

- Reports must be individually written in a ***neatly organized*** and ***presentable*** style.
- Write your solutions in a ***clear, well thought*** manner and provide enough ***details*** as though you were explaining your ideas and their importance to someone who has not yet learned them. Someone very much like yourself or your classmate, who has the same level of understanding as you do. Also, avoid writing (just for its own sake) confusing or misleading sentences if you yourselves are confused.

  This will help you to review and understand thoroughly 'your own solutions' later (review, exams, etc.), without additional effort. In particular, it will be helpful when you have to interrupt your work for some reason and come back to it later. Furthermore, in doing so you will learn how to communicate mathematics correctly, which is an excellent way to enhance and reinforce your knowledge and concepts. It will also help you realize misconceptions and misunderstandings.
- Use correct ***mathematical notations*** and define them whenever needed, to avoid ambiguity.

  (You should pay a particular attention to how symbols and notations were used in class and in the textbook to convey concepts.)
- State and justify any necessary ***assumptions*** if not assumed in the problem.
- ***Label*** graphs and tables for easy reference.
- Use ***separate sheets*** for each problem, ***number*** the pages and after finishing ***staple*** them in ***numerical order*** so that they may not have a chance to be overlooked by the reader / grader.

❑ Grading will be based on:

- Your approach on the above instructions.
- ***Completeness*** and ***coherence*** of your solutions. (Just a final answer is not a solution). Absolutely, ***no credits*** will be awarded for unsupported answers and/or scratch work.
- ***Individuality*** of your work.

  While discussing ideas and concepts with classmates are strongly recommended but shared printouts or copied solutions will not be graded for any of the involved parties. Remember you do your friends a bigger favor if you let them write their own solutions, because that is how they learn the subject matter.
- Your solution's ***relevance*** and ***connection*** to the course curriculum.

  Some of the problems (specially the simple ones) can be solved by using common sense, such as trial and error methods, using graphing tools or software, etc. However, your written solution must reflect your ***competence*** in understanding of the calculus methods taught in the course. Therefore, if you arrive to a solution by above mentioned methods, think about its relevance and connection to the ideas and concepts learned in the course and then write your solution by giving a more ***mathematical approach*** to it. In any case, don't hesitate to explain your approach to the problem. This is the essence of mathematics: It takes an elementary problem that can be solved by elementary methods of discovery and then develops the tools necessary to solve more complex and general problems of the same type.

❑ Helpful suggestions for solving problems:

- Start working on the project *immediately*, because you never know what obstacles you might face and have to overcome. They might take more time than anticipated.
- Before attempting any problem in your projects, make sure you ***have thorough understanding*** of the subject matter beforehand.

  In particular, attempt those problems after you have read the book and notes (which you must have them organized at this point) very carefully for they may include helpful hints or approaches that you can refer back to. Also, do every single assigned practice problem as a warm-up to prepare yourself for the bigger challenge.

- ***Have positive attitudes*** toward learning new material (after all, a negative attitude will hurt only you by impeding you from learning). You will appreciate the importance of challenging exercises in learning and understanding the material. They will motivate you to ***explore and make connections*** with 'real- life' type problems.
- Read the questions carefully by paying closer attention to the *technical words* and in the mean time draw a mental picture of the problem. Also, ***reread*** the questions after solving them and see if you have missed a question or instruction.

  Many students overlook very simple questions that they know the answers for, because of haste.
- Remember that the assigned problems are ***doable*** by someone of your level. They are not meant to intimidate you in any way, but to help you further *explore, make connections,* understand the subject matter, and in the process become confident in bigger challenges. Some problems may (and will) even have similar concepts or approaches to those examples in your book or notes, and perhaps all you need to do is just ***look closer*** and ***harder***. Always assume that all the essential concepts needed to do those types of problems were covered in the class (because they will be). So ***have confidence*** in yourself and do everything you can to solve them.
- You should neither expect nor accept 'template' type problems. That is, some 'mimicking' technique or approach to every problem situation without actually learning the concepts. For instance, **don't expect** the teacher to show you how things are done in such and such cases and then have you solve the exact same problem with different numbers.

  Researchers believe that students learn most when they actively construct their own knowledge from complex situations rather than have all the information handed down to them, with nothing left for their imagination or intelligence to work on. Therefore, template type problems will do disservice to the students by not letting them to develop their own style of thinking, and in the process they will lose the sight, the beauty, the power and appreciation of mathematics. This however is not meant to lighten the burden of the instructors, because they will have to be more patient, creative and hence work harder in order to stimulate and challenge their students' thinking at different levels.

  On the other hand, the students understand solutions best, when provided by the instructor, and retain them longer after they had done their very best in finding the answers.
- ***Be patient*** and spend as much time as necessary to find a solution to a problem. Some students may think they have no idea about the problem, but often times that is the case of insufficient preparation. In that case, you have to ***review*** and repeat reviewing the material as many times as needed, but this time ***pay closer attention*** to the ideas that are connected to the problem at hand and try to analyze them further.

  Warning: Reviewing may not help if you have bad habits of studying, such as; inactive learning, thinking of something else, sloppy notes, rushing through and building upon a weakly understood concepts, etc. If you have adopted a good learning approach, it should never leave you clueless about the problems. Otherwise, you may need to revise your learning strategies and/or seek help, but only after you tried your very best and honest know how approach.

  Students' frustration with these types of assignments is often linked to either not understanding the instructions/questions or not having mastered the required skills. If the problem seems to be that you honestly can't do it, discuss the situation with your instructor who will gladly offer additional help or suggestion. Remember, the purpose of these homework assignments is not to give you a bitter lesson but to have you learn as much as possible by exploring further and making useful connections with the real world.
- Each assigned problem is meant to teach you something, whether it is a routine mechanical work or of indirect nature. Take few moments to step back and ***reflect*** upon what you learned. Try to look for patterns, ideas or generalizations that emerge from the situation in the problem and relate them to other situations or problems in your experience.

  These perspectives will help you to refine strategies into efficient, problem solving techniques, deepen your knowledge of mathematical ideas and concepts and make connections to other mathematical situations.
- Last but not least. *Prolonged efforts* to learn will help you remember the concepts for longer periods to come. They will also nurture a way of *critical thinking* as a second nature, which your peers will appreciate and reward.

  Learning math is like playing a musical instrument or some sports; you can learn how to play well only after much practice and hard work. Furthermore, like a musician or an athlete you may need to practice even more on some particular areas that you feel is your weakness.