Math 20550 - Calculus III
Course Syllabus
Summer 2014

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Office	:	Hurley 295
Class Time	:	MTWRF 8:45-10:30
Class Location	:	Hayes-Healy 229
Office Hours	:	M 13-14:30, T 16-17:15, W 10:45-12 & 19-20, R 13-14:30, F 11-12:30 and by appointment
Course Webpage	:	http://www3.nd.edu/∼eburkard/?page=Teaching/20550U14

1. Course Description

From the catalog: A comprehensive treatment of differential and integral calculus of several variables. Topics include space curves, surfaces, functions of several variables, partial derivatives, multiple integrals, line integrals, surface integrals, Stokes theorem, and applications.

My Description: This course covers the calculus of functions of several variables and vector valued functions. In this course, we will cover generalizations of results from Calculus I & II to higher dimensions; generalizations of results such as the second derivatives test, u-substitution, and the fundamental theorem of calculus; as well as topics unique to higher dimensions. We will go over several physics applications throughout the class in order to illustrate the extraordinary usefulness of the calculus of several variables; for example, conservation of energy, Gauss' law, Ampère's law, and Maxwell's equations. Calculus III is also the "baby version" of the mathematical field called *Differential Geometry*, which is fundamental to modern physics. I will hint at the more general versions of results occasionally to give you an idea of what comes after this class.

2. Prerequisites

The prerequisite for this class is Math 10560 (Calculus II) or Math 10860 (Honors Calculus II), or their equivalents. Basically, you will need to be able to carry out integration and differentiation, as well as know how to apply these in various ways as was done in Calculus I&II, e.g., extremization, finding areas, etc.

3. Course Technicalities

Each class meeting is 105 minutes, approximately 2 standard semester class meetings. This means you will be expected to work twice as hard each day as you would during the semester. Class also meets all 5 weekdays, so you should expect to be working on homework every day. An inescapable fact of summer school courses is that they are quite dense.

4. Grade

There is a total of 500 points for the class. The point breakdown is as follows:

Item	Exam I	Exam II	Exam III	Final	Homework	Project	Attendance
Points	60	100	100	150	60	20	10
% of grade	12	20	20	30	12	4	2

Your grade will be determined by the percentage of the total points you've obtained. The grade scale will be no stricter than

Letter	A	B	C	D	F
Cutoff	92%	82%	72%	57%	0%

with +'s and −'s to be used as needed for the final grade only. Due to the fact that there are no Math for Everyone talks over the summer, there will be other extra credit opportunities at some point.

5. Textbook

The textbook for this class is *Calculus, 7e*, by James Stewart. There are several options available to you. I have placed 3 orders to the bookstore, of which you should choose one. You can also order these directly from the publisher, Cengage, by visiting their site, cengagebrain.com, and searching the ISBN below.

(1) The first is the hybrid edition of the multivariable part of the textbook. This comes with a 1-term access code to WebAssign, where the computational homework will be. The ISBN is 978-1-133-11083-5.
(2) The second is the hybrid edition of the whole book. This comes with a "lifetime of edition" WebAssign access code. As Calc III is the terminal course for this book, you don't actually need this particular type of access code. I made this an option in case you wanted to buy an entire calculus book. The ISBN is 978-1-133-11271-6.
(3) The final option is to just buy access to WebAssign. You can do this directly on the webassign website. Webassign access comes with access to an eBook. This will be the cheapest option.

Again, all of these options should be available through the bookstore.

Really, I think the cheapest option would be to buy webassign access, and if you want a hard copy of a book, the previous editions of the textbook can be found cheaply online. There are other books, which I personally think are better, that you could also buy:

- Calculus by Larson - This book is at the same level as Stewart, and in my opinion, much better. I was going to use this as the textbook, but it wasn't very well supported in WebAssign.
- Vector Calculus By Colley - This book gives you a "proper" coverage of the calculus of several variables using linear algebra. For the student wishing to go further in math, I highly recommend this book.

Calculus, at this level, has been the same for over 100 years at this point. There really isn't anything new to say in newer editions. The only reasonable thing to expect from newer editions of books is better expositions of material and maybe a better pedagogical flow.

6. Exams

There will be 3 exams over the course of the class, and will take place during the regularly scheduled class time, 8:45-10:30. Exam I will only cover Chapter 12, and as such will be shorter than the other exams. Exam I will take place on the first Friday of the class, June 20th. This is intended to

give you feedback at the end of the first week, so you can guage where you are in the class (since 1 summer week = $3\frac{1}{3}$ standard semester weeks). There will be a short lecture after Exam I. Exam II will take place on July 3rd and will cover through Chapter 14. Exam III will take place on July 16th and will cover up through Section 16.4, on Green's Theorem. There will also be a cumulative final exam on the last day of the class.

Exam make ups will only be given with an excuse from the appropriate campus personnel. Anyone who misses an exam and does not have an appropriate excuse will receive a 0 for that exam. Travel plans, sleeping in, defective alarm clocks, etc. ARE NOT a valid excuse for missing an exam. If you have a valid excuse (illness, excused athletic absence, etc.) for missing an exam, please contact me ASAP (preferably before the exam) and a makeup exam will be scheduled. NO CALCULATORS will be allowed on the exams.

7. Homework

The homework is done online though WebAssign, and can be accessed at webassign.net. The class key is:

nd 0900 1821

If you had Calculus I or II and already have a WebAssign username, you can log in with that. If you don't have a WebAssign account, the procedure is as follows:

(1) go to webassign.net
(2) click on "I Have a Class Key"
(3) enter the class key from above
(4) verify that the course is "Math 20550 — Section 01". I should show up as the instructor, and University of Notre Dame should show up below that.
(5) click on "Yes, this is my class."
(6) choose "I need to create a WebAssign account" and click continue
(7) you will then be asked to fill out several fields:

Username- this can be anything you want, as long as it's something you'll remember. A good option is your netID
Password- your choice. It is highly recommended you use a password distinct from your Notre Dame password.
First Name- please enter this *exactly* as it appears on your Notre Dame ID.
Last Name- please enter this *exactly* as it appears on your Notre Dame ID.
Email Address- please use your Notre Dame email address.
Student ID Number- please use your netID, **NOT** the ID number on your ID card.
I ask that you use this information because I need to be able to match it to the information provided to me by the registrar in order to assign you a homework grade.

(8) Create your account. You'll be ready to start your homework now!

It's worth pointing out that you get the first 2 weeks of access for free, so you don't have to actually purchase anything for a little while. It is highly suggested that you keep a notebook with your solutions to your online homework so that you can have a record of how to solve the problems to study from. Online homework due dates are as follows. The assignments are due at 2am the night of the given day (e.g., if the due date is 6/18, the deadline for submission is 2am on 6/19). I have set up the due dates this way so if you decide to work on homework last minute (which I don't recommend!), you have a bit more time in case something goes wrong. As all of the homework is available from the beginning of the class, no late homework will be accepted on WebAssign.

Date	Section(s)	Date	Section(s)	Date	Section(s)	Date	Section(s)
6/18	12.1 12.2 12.3	6/27	14.3 14.4(*) 14.6g	7/9	15.4 15.7	7/16	16.4
6/19	12.4 12.5l 12.5p 12.6	6/30	14.5 14.6	7/10	15.5 & 15.7 - M 15.8	7/21	16.6
6/21	13.1	7/1	14.7	7/11	15.9 15.10	7/22	16.7
6/23	13.2	7/2	14.8	7/14	16.1 16.2	7/23	16.8
6/25	13.3 13.4	7/7	15.1 15.2 15.3	7/15	16.3 16.5	7/24	16.9
6/26	14.1 14.2						

(*) The homework assignment for Section 14.4 is an optional, extra credit assignment.

You are expected to turn in your own work. You are allowed to, and even encouraged to, work together on the homework, but you must turn in your own work. In particular, you are not allowed to share your WebAssign password with someone else, nor are you allowed to have someone else enter solutions into WebAssign for you.

8. Project

In order to give you a deeper understanding of the material as it relates to the "real world", you will have to give an approximately 10 minute presentation on an application of something from the course material. A rough timeline for the project is: have a topic picked by the end of week 1, by the end of week 2 have a paragraph or so describing what you will talk about, submit a copy of your presentation materials to me at least 2 days BEFORE your presentation, and finally give your presentation at any point you're ready given two constraints: 1) you MUST present on July 23rd at the LATEST and 2) your presentation should take place AFTER the material is presented in class.

9. Attendance

It is imperative that you attend class every day. Not only does it contribute to a portion of your grade, but falling behind by one class day is the equivalent of falling behind by two days during the semester, almost an entire week!! This compounds with the fact that class takes place every day, so you don't even have the day in between classes like you would in the normal semester to catch up. As attendance cannot be made up, if you miss class with an approved excuse, you will be given the attendance points for the day(s) missed.

10. Help Resources

There will be tutoring available on Mondays and Wednesdays from 7-8:30pm through the Learning Resource Center (LRC). The tutoring will take place in the Coleman-Morse Center, room 242.

The textbook has a companion webpage:

stewartcalculus.com

which contains several helpful things such as: homework hints, additional resources for various topics throughout the text, among other things. When choosing your book, you should actually choose the "Early Transcendentals" version of the book to make the chapters match up. If you choose the other, all the chapters for this class are one further (e.g., chapter 12 on vectors is now chapter 13). There is no difference in content however.

I will have office hours, and if you need extra help, I'm willing to set up extra time to meet with you.

11. Mathematical Software

Frequently in class I will use the software *Mathematica* to create visuals of various concepts. A free copy of Mathematica is available to you through the OIT website:

oit.nd.edu/software-downloads/mathematica/

This requires that you log in with your netID. I highly recommend getting this, or some other software, in order to help you visualize things. I do want to emphasize, this is recommended, not required.

12. Honor Code

As members of the Notre Dame community, we will not tolerate academic dishonesty. The Honor Code is in effect for all exams. Students will not give or receive aid on exams. This includes, but is not limited to, viewing the exams of others, sharing answers with others, and using books or notes while taking the exam. You may not talk about an exam to anyone who has not already taken it until the answers are posted on the website. This includes people who are not taking the course! Violations will not be tolerated and will be prosecuted! Please see the above section on homework for details about the Honor Code relating to homework. You can find more about the Honor Code here: honorcode.nd.edu

13. Conduct

You are expected to act in a respectable manner. If you are disruptive, you will be asked to leave, and you will forfeit your attendance points for the day. If you have a cell phone, please turn it off (or at least place it on silent) during class time. Lectures being interrupted by cell phones going off is disrespectful and extremely annoying.

14. Other Important Information

The drop deadline to receive a full refund is June 23rd, and the standard drop deadline is July 5th. Dropping after July 5th will result in a "W" on your transcript.

I reserve the right to change any information in this syllabus in the event of an unforeseen event.

15. Course Outline

Here is a proposed course outline. This will be adjusted if needed as the course progresses. You should read the sections to be covered in class before the day they are covered: you do have a textbook for a reason!

6/16
- 12.1 - $\mathbb{R}^3$, Distance, Spheres
- 12.2 - Vectors, Forces
- 12.3 - Dot product, Work

6/17
- Finish 12.3 if needed
- 12.4 - Cross Product
- 12.5 - Lines in Space: parametric, vector, symmetric; Continue onto Planes if time permits

6/18
- 12.5 - Planes: standard and vector forms; intersection of two planes; distance between points, planes, and lines
- 12.6 - Surfaces in Space: cylinders and quadrics
- 13.1 - Vector Functions and Space Curves

6/19
- Review and Practice for Exam I

6/20 EXAM I (50 minutes)
- Finish 13.1 if needed
- 13.2 - Derivatives and Integrals of Vector Valued Functions

6/23
- 13.3 - Arc Length, Parameterizing by Arc Length, Curvature, Frenet-Serret Frame, Normal and Osculating Planes
- 13.4 - Velocity and Acceleration, Projectile Motion

6/24
- Finish 13.4 if needed
- 14.1 - Functions of Several Variables, Graphs, Level Curves/Surfaces, Contour Plots
- 14.2 - Limits, Continuity

6/25
- 14.3 - Partial Derivatives, Higher Order Partial Derivatives, Clairaut's Theorem
- 14.4 - Definition of Differentiability, Differentiability $\Longrightarrow$ Continuity
- 14.6 - The Gradient
- 14.5 - Begin Chain Rule

6/26
- 14.5 - Finish Chain Rule, Implicit Differentiation, Related Rates
- 14.6 - Directional Derivatives, Tangent Planes, Normal Lines

6/27
- Finish 14.6 if needed
- 14.7 - Absolute and Relative Extrema, Critical Points, Second Derivatives Test, Optimization

6/30
- 14.8 - Lagrange Multipliers

7/1
- 15.1 - Double Integrals over Rectangles
- 15.2 - Iterated Integrals
- 15.3 - Double Integrals over General Regions

7/2
- Finish 15.3 if needed
- Review/Practice for Exam II

7/3 EXAM II (Written to be a 75 minute exam)

7/4 Independence Day - No Class

7/7
- 15.4 - Double Integrals in Polar Coordinates
- 15.7 - Triple Integrals

7/8
- 15.5 & 15.7 - Mass, Moments, Center of Mass
- 15.8 - Integration in Cylindrical Coordinates

7/9
- 15.9 - Integration in Spherical Coordinates
- 15.10 - Change of Variables

7/10
- 16.1 - Vector Fields
- 16.2 - Scalar Line Integrals, Mass, Center of Mass, Start Vector Line Integrals if possible

7/11
- 16.2 - Vector Line Integrals, Work
- 16.5 - Curl, Divergence
- 16.3 - Fundamental Theorem of Line Integrals, Conservative Vector Fields, Conservation of Energy

7/14
- Finish 16.3 if needed
- 16.4 - Green's Theorem
- 16.5 - Vector Forms of Green's Theorem

7/15
- Review/Practice for Exam III

7/16 EXAM III (Written to be a 75 minute exam)

7/17
- 16.6 - Parametrized Surfaces, Normal Vectors and Tangent Planes, Surface Area

7/18
- 16.7 - Surface Integrals, Orientation/Orientability of a Surface, Flux Integrals

7/21
- 16.8 - Stokes' Theorem

7/22
- 16.9 - Divergence Theorem

7/23
- Last day for presentations! Catch-up? Review? Gauss-Bonnet?

7/24
- Review/Practice for the Final

7/25 FINAL (Written to be a 100 minute exam)