Multivariable Calculus

MATH 261, Spring 2016
Sections 02 and 03

Instructor: Stephen Flood

Office: DMF 443, in the Center for Science & Mathematics (near the Rondileau Campus Center).

Office Hours: Monday 11:00-12:00 and Tuesday/Thursday 3:30-4:30.
Open Door Policy: If my door is open, then I am happy to answer quick questions!

Email: `stephen.flood@bridgew.edu`
Email Policy: I try to respond to questions by some time the next business day.

Textbook: *Calculus: Early Transcendentals* 3rd edition by Rogawski.

Important Websites

1. **My Website:** General information about this section, including my office hours, and some study aids will be posted at `http://www.mathlogic.org/stephenflood/teaching.html`
2. **WebAssign:** Online homework and grades will be posted on WebAssign.

   To access WebAssign, go to https://www.webassign.net/v4cgi/selfenroll/classkey.html and enter your class code. **Section 02:** bridgew 6616 4022. **Section 03:** bridgew 1077 3535.

   After you create a username and password, you can log in from https://www.webassign.net
3. **Email:** It is important to regularly check your Bridgewater email.

Course Description

This course is a continuation of the MATH 161/161E - MATH 162 Single Variable Calculus I-II sequence. Topics will include parametric and polar equations, derivatives and integrals of multivariable functions, and vector analysis.

Learning Outcomes

1. Understand the geometry of 2D and 3D space, including fluently using vectors to answer questions about the geometry of lines curves, planes, and surfaces.
2. Understand the rate of change of vector-valued functions. Use this knowledge to visualize and draw graphs of surfaces in space.
3. Compute rates of change (derivatives) and areas (integrals) for functions with several input variables. Use these rates of change to discuss maxima and minima (optimization problems).
4. Understand and analyze vector fields.
5. Know and apply the fundamental theorems for vector fields (line integrals, Green's theorem, etc.)

Formats and Procedures

The course consists of 3 parts

1. In class lecture (4 hours/week)
2. Regular Homework Assignments (8-12 hours/week)

3. Studying to prepare for homework and quizzes (normally ∼4 hours/week, but more before an exam).

The suggested study times for the *average* student (see any website about studying in college). If you are weak in mathematics, you will require more time, but **please talk to me** and I can help you work more efficiently. You can also find useful advice online:

- Math Study Skills: http://mathcs.slu.edu/undergrad-math/success-in-mathematics

Grades

Your grade will be earned as follows. There is no extra credit.

Exam I and II	20% *each*
Online Homework	10%
Quizzes & Written Homework	20%
Final Exam	30%
Total	100%

Exams, homework, and quizzes will be graded for correctness, completeness, and clarity. The more clear your explanation and organization, the more points you will earn! This also means that points may be deducted for confusing organization and poor handwriting, as well as for incomplete or incorrect work.

Exams

There will be two in-class exams and one final exam. The final exam will be cumulative: anything we've studied is fair game. The in-class exams generally cover the material since the last exam. No calculators will be permitted on any exam.

No makeup exams are scheduled. If you miss an exam for a valid reason (documented illness, documented family emergency, etc.), your exam grade will be determined by averaging the other exams. At my discretion, I may choose to assign a makeup exam instead.

Tentative dates are given in the Approximate Calendar of Study, below. *Please contact me before the exam* if you will need to miss it. It is much harder to document "valid reasons" after you have missed the exam.

Quizzes

There will be occasional quizzes. These will be short assignments, and their main purpose is to give you a chance to use, practice, and explore the concepts and tools that we are learning.

In class quizzes and graded worksheets will be announced in advance, and you cannot make them up.

Homework

The best way to learn mathematics is to get a lot of practice with (i) performing computations, (ii) using and connecting concepts, and (iii) writing clear explanations.

Graded Homework will be assigned from every class, and collected each week. Your assignment grade will depend on two things. (1) Part of your grade is based on whether *all problems were attempted* with complete and clear work, and (2) Part of your grade is based on *grading a few problems for correctness* of your answer and work.

In addition to the graded homework, you also have recommended homework: read the book and do as many practice problems as you can. You can find a list of recommended practice problems on the course page.

How to succeed in this class

Calculus is about a mixture of *concepts* and *computations*. Some problems on the homework simply practice ideas covered in class. Other problems will combine the "computations" and "concepts" in *a variety of new ways*. From time to time **you will** become stumped by a problem. In this case, **you should** come to my office hours, drop by my office, or email me to ask for a hint or explanation.

Group Work

Group work can be helpful, **but I strongly encourage you** to *work on problems yourself first*, before discussing them with your peers. Probably the best way to check that you understand a problem is to ask this question: "Can I reproduce the solution and explain it to a classmate a whole 10 minutes after I finished the problem?" Try this with the people you are studying with, and have them check your reasoning.

Study Aids

You have many excellent resources available to aid you as you work. For example, *you can ask me any and all questions during office hours!* You also have answers to the odd numbered problems in the textbook.

You even have access to free tutoring through the Math Resource Center, which is located in the Maxwell Library Ground Floor (AAC). This resource center is open from Monday to Friday, for between 7 and 12 hours each day. You can learn more about the center, including their exact hours, online at
`https://my.bridgew.edu/departments/MathServices/SitePages/Home.aspx`

But please remember: you will benefit the most if you *make a serious effort to solve the problems on your own* before you obtain other assistance.

Students with Disabilities

At BSU, we are committed to making our facilities, services, and programs accessible to all students in compliance with applicable law. Students with disabilities who desire reasonable accommodations should contact the Disability Resources Office to discuss the availability of reasonable accommodations or to obtain documentation guidelines. They are located in the Maxwell Library Ground Floor (AAS). You should also contact me by email or during office hours to discuss accommodations due to a documented disability.

Final Letter Grades

The final letter grade cutoffs are as follows:

Percentage:	94	90	87	83	80	77	73	70	60	0
Letter Grade:	A	A-	B+	B	B-	C+	C	C -	D	F

Academic Integrity

Academic honesty is expected of all students. Plagiarism and cheating are subject to academic penalty, which may result in a grade of F for the whole course. In fact, *a violation may result in a reduced grade, suspension, or dismissal from the university.*

You must not not cheat, fabricate, plagiarize, or facilitate academic dishonesty. If you passively engage in cheating (i.e. allowing others to cheat off you) you may receive the same consequences as the person copying.

Important Dates

Last day to add/drop: January 27, 2016. *Last day to withdraw:* April 8, 2016.

Tentative Exam Dates: February 25 and April 5.

Final Exam Date:

Section 02 (meeting TR 12:30 PM): Thursday, May 5 11:00 AM – 1:00 PM.

Section 03 Schedule for (W 1:50 PM): Wednesday, May 4 2:00 PM – 4:00 PM

Approximate Calendar of Study

This schedule is a preliminary outline, and you should expect it to change from time to time. For example, it is likely that the days marked "review" will include some amount of new material.

Lesson		Date	Section	Topic	Remarks
1	1	20-Jan	11.1	Parametric Equations	
	2		11.1 & 11.3	Calculus of Parametric Equations and Polar Coordinates	Worksheet
2	3	25-Jan	11.3	Polar Equations and Functions	Quiz
	4		11.3	Area in Polar Coordinates I	
	5		11.4	Area in Polar Coordinates II	
3	6	1-Feb	12.1 & 12.2	Vectors in the Plane and 3D	
	7		12.1 & 12.2	Vectors in the Plane and 3D	
	8		13.1 & 13.2	Vector Valued Functions and Their Derivatives	
4	9	8-Feb	13.2	Calculus of Vector Valued Functions II and the Dot Product I	Tangent Lines and Speed
	10		12.3	Dot Product II	
	11		12.3	Dot Product III and Cross Product I	
5	12	15-Feb	12.4	The Cross Product II	
				Monday Class Schedule – No Wednesday Classes	
	13		12.4 & 12.5	Planes in Three-Space I	
6	14	22-Feb	12.5	Planes in Three-Space II and Cylindrical Coordinates	
	15		12.7	Exam I Review	
	16			Exam I	
7	17	29-Feb	12.7	Spherical Coordinates	
	18		14.1	Functions of Two or More Variables	
	19		14.3	Partial Derivatives	
8		7-Mar		Spring Break – No Class	
				Spring Break – No Class	
				Spring Break – No Class	

Lesson		Date	Section	Topic	Remarks
9	20	14-Mar	14.3	Partial Derivatives and Antiderivatives	
	21		14.2	Limits and Continuity in Several Variables	
	22		14.4	Differentiability and Tangent Planes	
10	23	21-Mar	14.4	Differentiability and Tangent Planes	
	24		14.6 & 14.5	The Chain Rule for Paths and Directional Derivatives	
	25		14.5	The Gradient I	
11	26	28-Mar	14.5	The Gradient II	
	27		14.7	Optimization in Several Variables I	
	28		14.7	Optimization in Several Variables II and Exam II Review	
12	29	4-Apr		Exam II	Last day to Withdraw
	30		15.1	Integration in Two Variables	
	31		15.2	Double Integrals over More General Regions	
13	32	11-Apr	15.2	Double Integrals over More General Regions	Includes Worksheet
	33		15.4	Polar Double Integrals and Applications of Integrals	
	34		15.3	Triple Integrals	
14	35	18-Apr	15.4	Triple Integrals in Cylindrical Coordinates I	
	36		15.4 & 16.1	Triple Integrals in Spherical Coordinates II and Vector Fields	
	37		16.2	Line Integrals I	
15	38	25-Apr	16.2	Line Integrals II and Conservative Vector Fields I	
	39		16.3	Conservative Vector Fields II and the FTC for Line Integrals	
	40		17.1	The Curl test and Green's Theorem	
16				Final Exam Week	