ELEMENTARY MULTIVARIABLE CALCULUS

The University of Toledo
Mathematics & Statistics Department, College of Natural Sciences and Mathematics
MATH2850-0XX, CRN XXXXX

Instructor:	(Insert Name)	**Class Location:**	(Insert Building/Room)
Email:	(Insert Email Address)	**Class Day/Time:**	(Insert Days/Time)
Office Hours:	(Insert Days/Time)	**Credit Hours:**	4
Office Location:	(Insert Building/Office #)		
Office Phone:	(Insert Phone Number)		
Term:	(Insert Semester/Year)		

COURSE DESCRIPTION

Geometry of functions of several variables, partial differentiation, multiple integrals, vector algebra and calculus (including Theorems of Green, Gauss and Stokes), and applications.

STUDENT LEARNING OUTCOMES:

Upon successful completion of this class a student should be able to:

1. **Vector-valued Functions:** Differentiate and integrate vector-valued functions. For a position vector function of time, interpret these as velocity and acceleration.
2. **Limits:** Evaluate limits and determine the continuity and differentiability of functions of several variables.
3. **Graphs:** Describe graphs, level curves and level surfaces of functions of several variables.
4. **Partial Derivatives:** Find partial derivatives, directional derivatives, and gradients and use them to solve applied problems.
5. **Tangent Planes:** Find equations of tangent planes and normal lines to surfaces that are given implicitly or parametrically.
6. **Chain Rule:** Use the chain rule for functions of several variables (including implicit differentiation).
7. **Extrema:** For functions of several variables, find critical points using first partials and interpret them as relative extrema/saddle points using the second partials test. Find absolute extrema on a closed region. Apply these techniques to optimization problems.
8. **Multiple Integrals:** Evaluate multiple integrals in appropriate coordinate systems such as rectangular, polar, cylindrical and spherical coordinates and apply them to solve problems involving volume, surface area, density, moments and centroids.
9. **Line/Surface Integrals:** Evaluate line and surface integrals. Identify when a line integral is independent of path and use the Fundamental Theorem of Line Integrals to solve applied problems.
10. **Vector Fields:** Find the curl and divergence of a vector field, the work done on an object moving in a vector field, and the flux of a field through a surface. Use these ideas to solve applied problems. Identify conservative fields.

11. **Important Theorems:** Introduce and use Green's Theorem, the Divergence (Gauss's) Theorem and Stokes's Theorem.

PREREQUISITES
Minimum grade of C- in Math 1860 or Math 1840 or Math 1930. Students who enroll in Math 2850 but have not passed either prerequisite may be administratively dropped from the class.

TEXTBOOK: *Thomas' Calculus, A Custom Edition for the University of Toledo*, 1st Edition, by George B. Thomas, Maurice D. Weir packaged with MyLabsPlus (ISBN: 9781269644334), Pearson.

UNIVERSITY POLICIES:

POLICY STATEMENT ON NON-DISCRIMINATION ON THE BASIS OF DISABILITY (ADA)
The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

ACADEMIC ACCOMMODATIONS
The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office (Rocket Hall 1820; 419.530.4981; studentdisabilitysvs@utoledo.edu) as soon as possible for more information and/or to initiate the process for accessing academic accommodations. For the full policy see: `http://www.utoledo.edu/offices/student-disability-services/sam/index.html`

ACADEMIC POLICIES:

STUDENT PRIVACY
Federal law and university policy prohibits instructors from discussing a student's grades or class performance with anyone outside of university faculty/staff without the student's written and signed consent. This includes parents and spouses. For details, see the "Confidentiality of Student Records (FERPA)" section of the University Policy Page at `http://www.utoledo.edu/policies/academic/undergraduate/index.html`

MISSED CLASS POLICY
If circumstances occur in accordance with The University of Toledo Missed Class Policy (found at `http://www.utoledo.edu/policies/academic/undergraduate/index.html`) result in a student missing a quiz, test, exam or other graded item, the student must contact the instructor in advance by phone, e-mail or in person, provide official documentation to back up his or her absence, and arrange to make up the missed item as soon as possible.

ACADEMIC DISHONESTY
Any act of academic dishonesty as defined by the University of Toledo policy on academic dishonesty (found at `http://www.utoledo.edu/dl/students/dishonesty.html` will result in an F in the course or an F on the item in question, subject to the determination of the instructor.

GRADING AND EVALUATION
The syllabus should describe the methods of evaluation whether quizzes, exams, or graded assignments. The usual procedure is to give at least two 1 hour in-class exams and a two hour final exam. If quizzes

are not used as a portion of the grade, then three 1 hour exams are recommended. How each evaluation method is to count toward the class grade should be described and a grading scale or description of a grading procedure should be provided. A sample reasonable distribution for this class would be:

Component	points
Homework and/or Quizzes	30%
Midterm Exams	40%
Final Exam	30%

It should be kept in mind when scheduling quizzes and exams that the last day to add/drop the class is the end of the second week of classes and the last day to withdraw from the class is the end of the tenth week. By these dates, students like to have some measure of their progress in the class.

IMPORTANT DATES
The instructor reserves the right to change the content of the course material if he perceives a need due to postponement of class caused by inclement weather, instructor illness, etc., or due to the pace of the course.

MIDTERM EXAM:
FINAL EXAM:

OTHER DATES
The last day to drop this course is:
The last day to withdraw with a grade of "W" from this course is:

STUDENT SUPPORT SERVICES
Free math tutoring on a walk-in basis is available in the Math Learning and Resources Center located in Rm B0200 in the lower level of Carlson Library (phone ext 2176). The Center operates on a walk-in basis. MLRC hours can be found at `http://www.utoledo.edu/utlc/lec/tutoring/math.html`.

CLASS SCHEDULE
Syllabus should provide a list of sections to be covered and it is advisable to give a tentative exam schedule. The suggested number of periods needed for each section is listed below. Most instructors find the syllabus to be quite crowded, so the course needs to be well paced to avoid cramming too much material in at the end of the semester. Most students will enroll in MATH 2860 that has MATH 2850 as a prerequisite.

Suggested Schedule

	12.6	Cylinders and Quadric Surfaces	1
Chapter	13	**Vector valued functions and motion in space**	(total 3.5 hr)
	13.1	Curves in space and their tangents; **Vector-valued Functions**	1.5
	13.2	Integral of vector functions; **Vector-valued Functions**	1
	13.3	Arc length in space; **Vector-valued Functions**	1
	13.4	**(Op.)** Curvature and normal vectors of a curve	
	13.5	**(Op.)** Tangential and normal components of acceleration	
	13.6	**(Op.)** Velocity and acceleration in polar coordinates	
Chapter	14	**Partial Derivatives**	(total 9.5 hr)
	14.1	Functions of Several Variables; **Graphs**	0.5
	14.2	Limits and continuity in higher dimensions; **Limits**	1.5
	14.3	Partial Derivatives; **Partial Derivatives**	1
	14.4	The Chain rule; **Chain Rule**	1.5
	14.5	Directional derivatives and gradient vectors; **Partial Derivatives**	2
	14.6	Tangent planes and differentials; **Tangent Planes**	1
	14.7	Extreme values and saddle points; **Extrema**	2
	14.8	**(Op.)** Lagrange multipliers	
	14.9	**(Op.)** Taylor formula for two variables	
	14.10	**(Op.)** Partial derivatives with constrained variables	
Chapter	15	**Multiple Integrals**	(total 10 hr)
	15.1	Double and iterated integrals over rectangles; **Multiple Integrals**	2
	15.2	Double integrals over general regions; **Multiple Integrals**	2
	15.3	**(Op.)** Area by double integration	
	15.4	Double integrals in polar form; **Multiple Integrals**	1.5
	15.5	Triple integrals in rectangular coordinates; **Multiple Integrals**	1.5
	15.6	Moments and centers of mass; **Multiple Integrals**	1
	15.7	Triple integrals in cylindrical and spherical coordinates; **Multiple Integrals**	2
	15.8	**(Op.)** Substitutions in multiple integrals	
Chapter	16	**Integration in vector fields**	(total 15 hr)
	16.1	Line integrals; **Line/Surface Integrals**	2
	16.2	Vector fields and line integrals: work, circulation and flux; **Vector Fields**	2
	16.3	Path independence, conservative fields, and potential functions; **Line/Surface Integrals**	1
	16.4	Green's theorem in the plane; **Important Theorems**	2
	16.5	Surfaces and area; **Line/Surface Integrals**	2
	16.6	Surface integrals; **Line/Surface Integrals**	2
	16.7	Stokes' theorem; **Important Theorems**	2
	16.8	The divergence theorem and a unified theory; **Important Theorems**	2
		Total Hours	39