**Elementary Multivariable Calculus**

The University of Toledo
College of Natural Sciences and Mathematics
CRN 12005 – MATH 2850 – 004

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Instructor: Seung-Moon Hong
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Office Hours: MW 9:00-10:30, 2:00-3:00
Office Location: UH 2030 J
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Term: Spring 2015

Class Location: UH 4010
Class Day/Time: MW 7:30–9:10 pm
Credit Hours: 4

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**Course/Catalog Description**: Geometry of functions of several variables, partial differentiation, multiple integrals, vector algebra and calculus (including Theorems of Green, Gauss ad Stokes), and applications.

**Student Learning Outcomes**:

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

1. Differentiate and integrate vector-valued functions.
2. Evaluate limits and determine the continuity and differentiability of functions of several variables.
3. Describe graphs, level curves and level surfaces of functions of several variables.
4. Find partial derivatives, directional derivatives, and gradients and use them to solve applied problems.
5. Find equations of tangent planes and normal lines to surfaces that are given implicitly or parametrically.
6. Use the chain rule for functions of several variables (including implicit differentiation)
7. 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. 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. 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.
10. Introduce and use Green's Theorem, the Divergence (Gauss's) Theorem and Stokes' Theorem.

**Prerequisites**: Passing grade in Math 1860 or Math 1840. Students who enroll in math 2850 but have not passed either prerequisite may be administratively dropped from the class.
**Textbook**: *Thomas' Calculus Early Transcendentals*, 12th edition by George B. Thomas, Maurice D. Weir and Joel Hass.
**University Policies**: 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.
**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.

**Calculator**: No calculators with symbolic or graphing capabilities are allowed during quizzes and exams. Cell Phones/Smart Phones are not allowed during quizzes and exams.
**Cell Phones and Laptop Computer Usage**: Please turn off your cell phone and keep it stored away. You can use a laptop computer to take notes, but it cannot be used for any other purpose.
**Attendance**: Your attendance to all classes is strongly encouraged. Any announcements made in class regarding the schedule of future classes, exams or other information takes precedence over this outline.
**Missed Quizzes and Exams**: If you miss a class you are responsible for obtaining the material, notes, etc. Absence for quizzes and exams can only be excused if covered by the University's missed class policy. The policy specifically mentions absences from class may be excused for personal emergencies, religious observances, participation in certain UT sponsored activities, and government required activities. For more information see http://www.utoledo.edu/facsenate/missed_class_policy.html. The student must contact me 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 Honesty**:Successful completion of this course requires personal integrity and honest academic effort. Any dishonest activities will not be tolerated in this course. Any student who engages in dishonest behavior will, at the instructor's discretion, fail the exam, fail the course, or more serious consequences. See the University's "Policy Statement on Academic Dishonesty".

**Homework**: It will be assigned but not collected.
**Quizzes**: There will be a quiz weekly. Some will be announced and some will not. No late quiz is accepted. To allow some unexpected cases, 1-2 of the lowest quizzes will be dropped.
**Exams**: There will be two in class exams and a comprehensive final exam given during scheduled final exam period for the section.

**Grading**: The following percentages are assigned to the components of the student's grade.
Quizzes 30%, Exam I 20%, Exam II 20%, Final Exam 30%.

The final letter grade will be based on your total average as follows:

| Total average | below 60% | 60% – 69% | 70% – 79% | 80% – 89% | 90% – 100% |
|---|---|---|---|---|---|
| Grade | F | D | C | B | A |

**Calendar**:

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|---|---|
| Last day to add/drop | Jan 26 |
| Exam I | Feb 11 |
| Exam II | Mar 18 |
| Last day to withdraw | Mar 27 |
| Final Exam | May 06, 7:30-9:30 pm |

**Schedule**:

| Week | Subject |
|---|---|
| 1 | 12.6 Cylinders and Quadric Surfaces |
| | 13.1 Curves in space and their tangents |
| | 13.2 Integral of vector functions |
| 2 | 13.3 Arc length in space |
| | 14.1 Functions of several variables |
| | 14.2 Limits and continuity in higher dimensions |
| 3 | 14.3 Partial Derivatives |
| | 14.4 The Chain rule |
| 4 | 14.5 Directional derivatives and gradient vectors |
| | 14.6 Tangent planes and differentials |
| 5 | 14.7 Extreme values and saddle points |
| | Exam I |
| 6 | 15.1 Double and iterated integrals over rectangles |
| | 15.2 Double integrals over general regions |
| 7 | 15.4 Double integrals in polar form |
| | 15.5 Triple integrals in rectangular coordinates |
| 8 | 15.6 Moments and centers of mass |
| | 15.7 Triple integrals in cylindrical and spherical coordinates |
| 9 | 16.1 Line integrals |
| | Exam II |
| 10 | 16.2 Vector fields and line integrals: work, circulation and flux |
| | 16.3 Path independence, conservative fields, and potential functions |
| 11 | 16.4 Green's theorem in the plane |
| 12 | 16.5 Surfaces and area |
| 13 | 16.6 Surface integrals |
| 14 | 16.7 Stokes' theorem |
| 15 | 16.8 The divergence theorem and a unified theory |