**Syllabus** **Math 2850, Elementary Multivariable Calculus**

The following items should be included on the syllabus distributed to the student at the first meeting.

**Office hours:** Time and place of office hours. University requirement is 5 hours for faculty and visiting faculty.

**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*, 12-th edition by George B. Thomas, Maurice D. Weir and Joel Hass. The text is available online at a 30% discount in electronic form from `www.coursesmart.com`. Students should be aware that in purchasing an electronic copy they will be responsible for printing it or accessing it electronically.

**Resources:** Students should be made aware of the tutoring help available during each week of the semester in the Mathematics Learning and Resource 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 on their web page at `http://www.utoledo.edu/utlc/lec/tutoring/math.html`.

**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. It should be kept in mind when scheduling quizzes and exams that the last day to add/drop the class is the 15th calendar day of the semester 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.

**Missed Classes:** Also be sure to publish a policy concerning missed exams and quizzes due to excused absence as directed by the University's missed class policy - see `http://www.utoledo.edu/facsenate/missed_class_policy.html`.

**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.

**Non-Discrimination Policy:** The University of Toledo is committed to a policy of equal opportunity in education, affirms the values and goals of diversity.

**Students with Disabilities:** The University will make reasonable academic accommodations for students with documented disabilities. Students should contact the Office of Accessibility (Rocket Hall 1820; 419.530.4981; officeofaccessibility@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/utlc/accessibility/faculty.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 3680 that has MATH 2850 as a prerequisite.

**Suggested Schedule**

| | | | |
|---|---|---|---|
| Chapter | 13 | **Vector valued functions and motion in space** | (total 3.5 hr) |
| | 13.1 | Curves in space and their tangents | 1.5 |
| | 13.2 | Integral of vector functions | 1 |
| | 13.3 | Arc length in space | 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 11.5 hr) |
| | 14.1 | Functions of Several Variables | 0.5 |
| | 14.2 | Limits and continuity in higher dimensions | 1.5 |
| | 14.3 | Partial Derivatives | 1 |
| | 14.4 | The Chain rule | 1.5 |
| | 14.5 | Directional derivatives and gradient vectors. | 2 |
| | 14.6 | Tangent planes and differentials | 1 |
| | 14.7 | Extreme values and saddle points | 2 |
| | 14.8 | Lagrange multipliers | 2 |
| | 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 | 2 |
| | 15.2 | Double integrals over general regions | 2 |
| | 15.3 | **(Op.)** Area by double integration | |
| | 15.4 | Double integrals in polar form | 1.5 |
| | 15.5 | Triple integrals in rectangular coordinates | 1.5 |
| | 15.6 | Moments and centers of mass | 1 |
| | 15.7 | Triple integrals in cylindrical and spherical coordinates | 2 |
| | 15.8 | **(Op.)** Substitutions in multiple integrals | |
| Chapter | 16 | **Integration in vector fields** | (total 14 hr) |
| | 16.1 | Line integrals | 2 |
| | 16.2 | Vector fields and line integrals: work, circulation and flux | 2 |
| | 16.3 | **(Op.)** Path independence, conservative fields, and potential functions | |
| | 16.4 | Green's theorem in the plane | 2 |
| | 16.5 | Surfaces and area | 2 |
| | 16.6 | Surface integrals | 2 |
| | 16.7 | Stokes' theorem | 2 |
| | 16.8 | The divergence theorem and a unified theory | 2 |
| | | Total Hours | 39 |

**Learning objectives:**
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. Use Lagrange multipliers to solve constrained optimization problems.
9. 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.
10. 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.
11. Introduce and use Green's Theorem, the Divergence (Gauss's) Theorem and Stokes's Theorem.