MAT 397 - Calculus III
Fall 2012

All sections

Course Description: MAT 397 is the third course in a three semester sequence in Calculus. This sequence is designed for Mathematics, Science and Engineering majors and for those students in other majors who intend to take advanced courses in mathematics. This course covers the concepts of vectors, vector valued functions, functions of several variables, partial derivatives and multiple integration.

Text: *Calculus: Early Transcendentals*, **7th ed.**, by James Stewart. (The material we will cover appears in Chapters 12 through 16.)

Background for Course: Completing MAT 296 (Calculus II) with a grade of C- or better is a prerequisite for MAT 397 (Calculus III). If you have not satisfied this prerequisite, you should drop MAT 397 and register for MAT 296. Students who earned a C or less in MAT 296 are unlikely to be successful in MAT 397.

Calculators: A calculator is not required for this course. **In particular, no calculators will be allowed on the exams or quizzes. Use or availability of any calculator or other electronic device on the exams or quizzes will be a violation of the Academic Integrity Policy.** You may use calculators for learning purposes and for solving homework. On exams and quizzes complete solutions, and not merely answers, must be presented to receive credit.

Course Format: The course format is two or three lectures (depending on your section) and a recitation each week. Your primary instructor will introduce new material in lecture. Your recitation instructor will answer questions on the course material and the assigned homework problems. Exams and quizzes will be given during recitation.

Class Attendance and Participation: You are expected to attend and participate in class. Missing class is the most common reason for poor performance in the course. If you miss a class, you are responsible for obtaining notes for that class from a student who attended. It is also your responsibility to find out about any announcements made in class.

Homework: Assignments for the entire semester are listed below. Each day's assignment should be completed before the next class meeting. Some variations from the list of homework exercises may be announced in class. Your instructor may elect to grade some homework assignments and to use these in determining your final grade. It is essential to do all the homework in a timely fashion!

Help: Your instructors will be available regularly during their office hours. You can also seek help at the Calculus Help Center located in 233 Physics Bldg. The Help Center hours are posted by 215 Carnegie Hall or you can obtain a copy of the schedule in the Math Department Office.

Examinations: There will be three examinations during the semester. They will be given in your recitation during the period listed below:

Exam 1, Sep 25-28, covers Chapters 12 and 13.

Exam 2, Oct 23-26, covers Chapter 14.

Exam 3, Nov 29-Dec 4, covers Chapter 15.

The exact date will depend on which day of the week your recitation meets. It will be announced during lecture by your primary instructor.

There will be NO MAKE-UP EXAMS. A missed examination counts as a zero unless you present a valid excuse from a physician or the Dean's office. With the written excuse, you may use your score on the relevant portion of the final exam to replace the missed exam. Your instructor will announce their policy on missed quizzes.

Final Examination: The final examination covers the entire course. It is a two-hour exam and will be given on: WEDNESDAY, Dec 12, between the hours of 8:00 a.m. and 2:30 p.m. The exact time and location of your final examination will be announced in lecture. The final examination is given at this announced time and at no other time. **Do not make plans to leave campus before 2:30 p. m. on WEDNESDAY, Dec 12.**

Grades: Each of the semester examinations counts for 20% of your course grade. The final examination counts for 25%, with the remaining 15% coming from quizzes and homework as decided by your primary instructor. Your course grade will be assigned based on the following percentages:

A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82),
C+ (77-79), C (73-76), C- (70-72), D (60-69), F (00-59).

Course Supervisor: Professor Dan Coman, 317 D Carnegie. Telephone 443-1496. E-mail dcoman@syr.edu. Please inform your instructor first of any problems you have. Problems not satisfactorily resolved with your instructor should be brought to the attention of the course supervisor without delay.

Students with Disabilities: If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS), http://disabilityservices.syr.edu, located in Room 309 of 804 University Avenue, or call (315) 443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue students with documented disabilities Accommodation Authorization Letters, as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible. Making arrangements with ODS takes time. Do not wait until just before the first test.

Academic Integrity Syracuse University sets high standards for academic integrity. Those standards are supported and enforced by students, including those who serve as academic integrity hearing panel members and hearing officers. The presumptive sanction for a first offense is course failure, accompanied by the transcript notation "Violation of the Academic Integrity Policy". The standard sanction for a first offense by graduate students is suspension or expulsion. Students should review the Office of Academic Integrity online resource "Twenty Questions and Answers About the Syracuse University Academic Integrity Policy" and confer with instructors about course-specific citation methods, permitted collaboration (if any), and rules for examinations. The Policy also governs the veracity of signatures on attendance sheets and other verification of participation in class activities. Additional guidance for students can be found in the Office of Academic Integrity resource: "What does academic integrity mean?"

Related links:

The Academic Integrity Policy: http://academicintegrity.syr.edu/academic-integrity-policy/

Twenty Questions and Answers about the Academic Integrity Policy: http://academicintegrity.syr.edu/faculty-resources/

What does academic integrity mean?: http://academicintegrity.syr.edu/what-does-academic-integrity-mean/

Religious Observances Policy: Syracuse University's religious observances policy, found at http://supolicies.syr.edu/emp_ben/religious_observance.htm, recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to are religious observance provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice (Student Services -> Enrollment -> My Religious Observances) from the first day of class until the end of the second week of class.

Learning Goals:

- Having a basic knowledge and understanding of the analytic and geometric concepts taught, and of some of their classical applications to other sciences, such as physics.
- Understanding the nature and role of deductive reasoning in mathematics.
- Ability to use mathematical notation.
- Ability to do hand calculations accurately.
- Ability to follow proofs and other mathematical discourse.

How to Succeed:

(1) It is absolutely essential that you understand how to solve the assigned problems. Quiz and exam questions will be similar to these problems. It is important to be able to use the skills and techniques presented in the course and not simply to be able to solve a specific set of problems.

(2) Ask questions in lecture, in recitation and at the clinic about anything that is not completely clear. Don't hesitate to bring questions to your instructors during office hours.

(3) Every day, read and study the sections in the textbook covered in the lecture. Learning mathematics takes time! Read carefully and work through all the examples in complete detail. It can be helpful to try to work through an example on your own before reading the solution.

(4) Stay caught up. Calculus concepts build on each other cumulatively and you need to stay on top of the material at every stage. If you are having difficulty, don't expect that the problem will take care of itself and disappear later. Contact your course instructor or your recitation instructor immediately and discuss the problem!

(5) Form a study group. Many students benefit from a study group to work through challenging problems and to review for exams. You should attempt the problems ahead of time by yourself and then work through any difficulties with your study partners. Explaining your reasoning to another student can help to clarify your own understanding.

(6) You should expect to work hard. Don't get discouraged if you find some of the material very difficult. Be persistent and patient! If you follow the above suggestions, your experience in this course will be a rewarding one.

Approximate Weekly Outline

Week 1 Aug 27-31: **12.1** Three dimensions, point notation, projections, distance, simple planes, spheres. **12.2** Vectors, addition, scalar multiplication, subtraction, components, the vector from one point to another point, length, algebra of vectors, basis vectors (for 2 and 3 dimensions), unit vector. **12.3** dot product, angle between vectors, perpendicular vectors, direction cosines, projections of one vector onto another.

Week 2 Sep 4-7: **12.4** Cross Product, orthogonality, angle between vectors, parallel vectors, area of parallelogram, algebra of cross product, volume of parallelepiped, coplanar vectors. **12.5** parametric equation for a line, symmetric equations, planes, normal to plane, vector and scalar equations of planes, parallel planes, distance from a point to a plane, angle between planes.

Week 3 Sep 10-14: **12.6** Cylinders, and six quadric surfaces, traces. **13.1** Vector functions, curves, limits. **13.2** Derivatives of vector functions, tangent vector to a curve, unit tangent vector, integrals of vector functions.

Week 4 Sep 17-21: **13.3** Arc length, normal, binormal, normal plane, osculating plane (skip parametrization with respect to arc length, curvature). **13.4** Velocity, acceleration (skip tangential and normal components of Acceleration and Kepler's Laws). **14.1** Functions of several variables, graphs in 3d, levels.

Week 5 Sep 24-28: **14.2** in 2d: Limits, exist, do not exist, sophisticated approaches, squeeze theorem, continuity, rational functions, compositions. Start **14.3** Partial derivatives, notation, geometric meaning, higher order, equality of mixed partials, Laplace equation, wave equation (and the example solutions). *Review and Exam 1.*

Week 6 Oct 1-5: Finish **14.3**. **14.4** Tangent planes to graphs in 3d, linear approximation, differentiability, total differential. **14.5** Chain Rule, implicit differentiation.

Week 7 Oct 8-12: **14.6** directional derivatives, the gradient vector, directional derivatives in term of the gradient, the direction and magnitude of the maximum rate of change. Tangent planes to level surfaces (3d). **14.7** Local extrema and partial derivatives, critical points, second derivative test, saddle points, absolute extrema for continuous functions on closed bounded sets**.**

Week 8 Oct 15-19: **14.8** Lagrange Multipliers (one constraint). **15.1** Double integrals (everything here is over rectangles), volumes (skip midpoint rule), average value. **15.2** Iterated integrals, Fubini's theorem (again all over rectangles).

Week 9 Oct 22-26: **15.3** double integrals over more general regions (than rectangles), evaluate using iterated integrals, properties of double integrals. *Review and Exam 2*.

Week 10 Oct 29-Nov 2: **15.4** Double integrals in polar coordinates, polar rectangles, regions between graphs of functions of theta, example 4 **15.5** Mass density, mass, moments, center of mass. **15.6** Surface area.

Week 11 Nov 5-9**: 15.7** Triple integrals (over a box), as iterated integrals (Fubini), triple integrals over more general regions, volume, center of mass. **15.8** Triple integrals in cylindrical coordinates.

Week 12 Nov 12-16: **15.9** Triple integrals in spherical coordinates. **15.10** Change of variable in double and triple integrals, add the problem: find the volume of the ellipsoid $(x+2y)^2 + (x-y+z)^2 + (x+3z)^2 =1$. **16.1** Vector fields, gravitational field in 3d, gradient fields, conservative vector field, potential function.

Weeks 13 & 14 Nov 26-Dec 7: Catch up. **16.2** Line integrals in 2d with respect to ds, dx, dy, along a curve C, orientation of C, line integrals in 3d with respect to ds, dx, dy, dz, line integrals involving vector fields, tangential component of the field. **16.3** Fundamental theorem for line integrals; (all in 2d) independence of path, piecewise smooth curves, closed curves, open connected sets, conservative vector fields, simple closed curves, simply connected region, finding the potential for a conservative field. **16.4** Green's Theorem, positively oriented simple closed curve, examples 4 and 5. *Review and Exam 3*.

Sect.	Suggested Assignment
12.1	3, 4, 7, 8, 9, 11, 13, 15, 17, 19, 22, 28, 32, 40.
12.2	1-5, 9, 11, 15, 17, 20, 21, 23, 25, 33, 35, 38, 49.
12.3	1, 3, 5, 6, 8, 9, 11, 23, 27, 35, 41, 44, 45, 51, 53.
12.4	1, 5, 7, 9, 13, 19, 23, 27, 31, 33, 37, 39, 45, 49, 53.
12.5	1, 3, 5, 7, 11, 12, 13, 14, 15, 16, 17, 19, 21, 26, 27, 30, 33, 35, 37, 41, 45, 47, 51, 55, 57, 61, 69, 75.
12.6	1, 3, 5, 9, 13, 19, 21-28, 33, 41, 43.
13.1	1, 3, 4, 5, 7, 11, 17, 21-26, 39, 41, 47.
13.2	1, 3, 5, 9, 11, 13, 16, 17, 19, 21, 23, 25, 35, 37, 39, 41, 44, 51, 53.
13.3	1, 3, 4, 47, 49.
13.4	3, 5, 9, 11, 14, 15, 19, 22, 23, 24, 25, 27.
14.1	9, 10, 13, 15, 17, 25, 29, 32, 33, 36, 47, 53, 59, 64.
14.2	1, 5, 7, 9, 11, 15, 19, 29, 31, 33, 37, 39.
14.3	11, 15, 21, 23, 25, 27, 35, 41, 47, 52, 53, 55, 59, 64, 67, 76, 91.
14.4	1, 3, 5, 11, 16, 19, 21, 33, 35.
14.5	1, 3, 5, 7, 11, 15, 17, 21, 26, 27, 29, 36, 38, 39, 49.
14.6	7, 9, 11, 13, 15, 19, 23, 25, 27, 29, 31, 33, 41, 43.
14.7	3, 5, 7, 9, 11, 13, 29, 31, 35, 39, 41, 51, 53.
14.8	3, 5, 7, 11, 20, 21, 27, 29, 31.
15.1	1a, 2, 11, 12, 13.
15.2	1, 3, 7, 11, 13, 15, 17, 19, 21, 29, 35.
15.3	1, 3, 5, 7-11, 13, 14, 15, 17, 18, 21-25, 27, 29, 35, 43, 46, 47, 53, 55, 62.
15.4	1-11, 14, 15, 17, 18, 20, 21, 29, 31, 35, 39.
15.5	1, 3, 5, 7, 15, 17, 19.
15.6	2, 3, 6, 9, 12.
15.7	3, 5, 9, 11, 13, 15, 19, 21, 27, 33, 39, 41, 45.
15.8	1, 2, 3, 5, 7, 9, 15, 17, 19, 25, 28, 29, 30.
15.9	1, 3, 4, 5, 7, 9, 11, 13, 15, 17-19, 21, 23, 26, 27, 29, 35, 39, 40.
15.10	1, 3, 7, 9, 15, 17, 19, 23, 25.
16.1	1, 3, 7, 9, 11, 13, 17.
16.2	1, 2, 3, 5, 19.
16.3	3, 5, 7, 9, 13, 19.
16.4	1, 3, 7, 9, 11, 13, 17.
	Final Exam: Wednesday, Dec 12. Time to be announced in class. It will end by 2:30 PM - Do not make plans to leave campus before then.