MAT 397 - Calculus III
Spring 2011

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 version) 6th Edition, by James Stewart, Thomson Brooks/Cole, 2008. (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: The TI-83+ is the recommended graphics calculator for this course. Students who already own and know how to use another equivalent calculator are free to use it. Calculators may or may not be allowed on exams and quizzes but symbolic calculators (such as the TI-89 or the TI-92) may not be used. On exams and quizzes complete solutions, and not merely answers, must be presented to receive credit. For example a numerical computation of an integral by calculator is not acceptable.

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 in the Reading Room of Carnegie Hall. 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, Feb 7-11, covers (approximately) Chapters 12 and 13(sections 13.1 and 13.2).

Exam 2, Mar 7-11, covers (approximately) Chapter 13 (13.3 and 13.4) and Chapter 14 (14.1-14.6).

Exam 3, Apr 11-15, covers (approximately) Chapter 14 (14.7 and 14.8) and Chapter 15.

The exact date will depend on which day of the week your recitation meets. Your primary instructor will announce the material covered by each exam during lecture.

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: MONDAY, MAY 9TH, 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 MONDAY, May 9th.**

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.

Course Supervisor: Professor Andrew Vogel, 229F Physics Building. Telephone 443-1584. E-mail alvogel@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. You are also welcome to contact me privately to discuss your academic needs although I cannot arrange for disability-related accommodations. Making arrangements with ODS takes time. Do not wait until just before the first test.

Academic Integrity: The Syracuse University Academic Integrity Policy holds students accountable for the integrity of the work they submit. Students should be familiar with the Policy and know that it is their responsibility to learn about instructor and general academic expectations with regard to proper citation of sources in written work. The policy also governs the integrity of work submitted in exams and assignments as well as the veracity of signatures on attendance sheets and other verifications of participation in class activities. Serious sanctions can result from academic dishonesty of any sort. For more information and the complete policy, see http://academic integrity.syr.edu

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.

Weekly Outline

Week 1 Jan 17-21: **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.

Week 2 Jan 24-28: **12.3** dot product, angle between vectors, perpendicular vectors, direction cosines, projections of one vector onto another. **12.4** Cross Product, orthogonality, angle between vectors, parallel vectors, area of parallelogram, Algebra of cross product, volume of parallelepiped, coplanar vectors.

Week 3 Jan 31 –Feb 4: **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. **12.6** Cylinders, and six quadric surfaces, traces, **13.1** Vector functions, curves, limits,

Week 4 Feb 7 -11: **13.2** Derivatives of vector functions, tangent vector to a curve, unit tangent vector, integrals of vector functions. *(Exam 1)* **13.3** Arclength, Curvature. (skip normal and binormal) **13.4** Velocity, Acceleration, (skip tangential and normal components of Acceleration and Kepler's Laws).

Week 5 Feb 14-18: **14.1** Functions of several variables, graphs in 3d, levels **14.2** in 2d: Limits, exist, do not exist, sophisticated approaches, Squeeze theorem, continuity, rational functions, compositions.

Week 6 Feb 21-25: **14.3** Partial derivatives, notation, geometric meaning, higher order, equality of mixed partials, Laplace equation, wave equation (and the example solutions). **14.4** Tangent planes to graphs in 3d, linear approximation, differentiability, total differential.

Week 7 Feb 28- Mar 4: **14.5** Chain Rule, Implicit differentiation **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).

Week 8 Mar 7-11: **(***Exam2***) 14.7** Local extrema and partial derivatives, critical points, Second derivative test, saddle points, Absolute extrema for continuous functions on closed bounded sets**. 14.8** Lagrange Multipliers (one constraint)

-------spring break ---------

Week 9 Mar 21-25: **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). **15.3** double integrals over more general regions (than rectangles), evaluate using iterated integrals, properties of double integrals.

Week 10 Mar 28- Apr 1: **15.3** finish **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.

Week 11 Apr 4-8**: 15.6** Triple integrals (over a box), as iterated integrals (Fubini), triple integrals over more general regions, volume, center of mass **15.7** triple integrals in cylindrical coordinates **15.8** triple integrals in spherical coordinates

Week 12 Apr 11-15: *(Exam 3)* **15.9** 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.

Week 13 Apr 18-22: **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

Week 14 Apr 25-29: **16.3** (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

Week 15 May 2-3: Finish/Review

Suggested Assignment
From 12.1: 3, 4, 7, 8, 9, 11, 13, 15, 17, 19, 22, 28, 30, 40
From 12.2: 1-5, 7, 9, 13, 15, 18, 19, 21, 23, 29, 31, 34, 43. From 12.3: 1, 3, 5, 6, 8, 9, 11, 23, 27, 31, 37, 40, 41, 47, 49.
From 12.4: 1, 5, 7, 9, 13, 19, 23, 27, 31, 33, 37, 39, 43, 45, 49. From 12.5 :1, 3, 5, 9, 11, 12, 13, 14, 15, 16, 17, 19, 21, 26, 27, 30, 33, 35, 37, 39, 43, 45, 49, 53, 55, 59, 67, 73. From 12.6: 1, 3, 5, 9, 13, 19, 21-28, 33, 41, 43.
From 13.1: 1, 3, 4, 5, 7, 11, 15, 19-24, 35, 37, 41. From 13.2: 1, 3, 5, 9, 11, 13, 16, 17, 19, 21, 23, 25, 33, 35, 37, 39, 42, 47, 49. From 13.3: 1, 3, 4, 43, 45.
From 13.4: 3, 5, 9, 11, 14, 15, 19, 22, 23, 24, 25, 27
From 14.1: 1, 6, 7, 9, 11, 15, 19, 23, 27, 30, 31, 32, 31, 41, 49, 55, 60. From 14.2: 1, 3, 5, 7, 9, 11, 15, 19, 27, 29, 31, 33, 37, 39.
From 14.3: 1, 3, 5, 11, 16, 19, 33, 35. From 14.4: 1, 3, 5, 11, 16, 19, 26, 27, 33, 35. From 14.5: 1, 3, 5, 7, 11.
From 14.5: 15, 17, 21, 25, 27, 29, 36, 38, 39, 49. From 14.6: 7, 9, 11, 13, 15, 19, 23, 25, 27, 29, 31, 33, 39, 41.
From 14.7: 3, 5, 7, 9, 11, 13, 29, 31, 35, 39, 41, 51, 53. From 14.8: 3, 5, 7, 11, 18, 19, 25.
From 15.1: 1, 3, 11, 12, 13. From 15.2: 1, 3, 7, 11, 13, 15, 17, 19, 21, 29, 33, 35. From 15.3: 1, 3, 5, 7-11.
From 15.3: 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 31, 39, 41, 43, 49, 51, 58. From 15.4: 1-11, 14, 15, 17, 18, 20, 21, 29, 31, 33, 35. From 15.5: 3, 5, 7, 15.
From 15.6: 1, 3, 5, 9, 11, 13, 15, 19, 21, 27, 33, 37, 39. From 15.7: 1, 2, 3, 5, 7, 9, 15, 17, 19, 23, 26, 27, 28. From 15.8: 1, 3, 4, 5, 7, 9, 11.
From 15.8: 13, 15, 17-19, 21, 23, 26, 27, 29, 35, 39, 40.

From 15.9: 1, 3, 7, 9, 11, 13, 15, 19, 21. From 16.1: 1, 3, 7, 9, 11, 13, 17, 23, 26.
From 16.2: 1, 2, 3, 5, 10, 13, 19, 21. From 16.3: 3, 5, 7, 9, 13, 19.
From 16.4: 1, 3, 7, 9, 11, 13, 17.