Math 221 - Calculus & Analytic Geometry III
Fall 2005 Course Syllabus

James Jones, Professor of Mathematics
Mathematics & Sciences Division
Richland Community College

Course Meeting Information
Section 01 meets from 5:30 pm to 7:20 pm on Mon and Wed in room S137.

Instructor Information
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Office Hours
These are the times are scheduled for my office hours. If these times are inconvenient for you, you may also catch me before or after class or make an arrangement to meet some other time.

- Monday: 11:20 am - 12:10 pm, 2:30 pm - 3:20 pm
- Wednesday: 12:00 pm - 12:50 pm, 2:30 pm - 3:20 pm
- Friday: 11:20 am - 12:10 pm

Text
Calculus: Late Transcendentals, 7th ed., combined. Howard Anton, Irl Bivens, Stephen Davis. Copyright 2002, John Wiley & Sons, Inc. ISBN 0-471-38157-8 (Required)
Student Resource Manual. Copyright 2002, John Wiley & Sons, Inc. (Optional)

Student Audience
Transfer students. Students pursuing degrees in engineering, mathematics, life sciences.

Prerequisite
Successful completion (C or better grade) of Math 122, Calculus and Analytic Geometry II.

Course Description
MATH 221 - Calculus and Analytic Geometry III
Hours: 4 lecture - 0 lab - 4 credit
Mathematics 221, Calculus and Analytic Geometry III, begins with the rectangular coordinate system in three-dimensional space, vectors, and operations with vectors. Lines, planes, quadric surfaces, spherical and cylindrical coordinates, vector-valued functions, curvature, Kepler's Laws of Planetary Motion, partial derivatives, relative extrema of functions of two or more variables, centroid, Lagrange Multipliers, and multiple integrals in different coordinate systems are introduced. At the end, students will learn integrals of functions over a curve or a surface, Green's theorem, the divergence theorem, and Stoke's theorem.

Applicable toward graduation where program structure permits.
- Certificate or degree: All certificates and all degrees.
- Group requirement: Mathematics
- Area of Concentration: Not applicable.

Illinois Articulation Initiative (IAI)

The mathematics component of general education focuses on quantitative reasoning to provide a base for developing a quantitatively literate college graduate. Every college graduate should be able to apply simple mathematical methods to the solution of real-world problems. A quantitatively literate college graduate should be able to:
- interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them;
- represent mathematical information symbolically, visually, numerically, and verbally;
- use arithmetic, algebraic, geometric, and statistical methods to solve problems;
- estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results; and
- recognize the limitations of mathematical and statistical models.

Courses accepted in fulfilling the general education mathematics requirement emphasize the development of the student's capability to do mathematical reasoning and problem solving in settings the college graduate may encounter in the future. General education mathematics courses should not lead simply to an appreciation of the place of mathematics in society, nor should they be merely mechanical or computational in character.

To accomplish this purpose, students should have at least one course at the lower-division level that emphasizes the foundations of quantitative literacy and, preferably, a second course that solidifies and deepens this foundation to enable the student to internalize these habits of thought.

> *Math 221, Calculus & Analytic Geometry III, satisfies the Illinois Articulation Initiative Definition of a General Education Mathematics Course. It corresponds to M1 900-3, Calculus III.*

The IAI course description for M1 900-3 follows.

M1 900-3: College-level Calculus III (3-5 semester credits)
Topics include (but are not limited to) the following: limits and continuity; definition of derivative: rate of change, slope; derivatives of polynomial and rational functions; the chain rule; implicit differentials; approximation by differentials; higher order derivatives; Rolle's Theorem: mean value theorem; applications of the derivative; anti-derivative; the definite integral; the fundamental theorem of calculus; area, volume, other applications of the integral; the calculus of the trigonometric functions; logarithmic and exponential functions; techniques of integration, including numerical methods; indeterminate forms: L'Hôpital's rule; improper integrals; sequences and series, convergence tests, Taylor series; functions of more than one variable, partial derivatives; the differential, directional derivatives, gradients; double and triple integrals: evaluation and applications. Prerequisite for Calculus III: Calculus II or equivalent of C or better.

Richland's Math 221, Calculus & Analytic Geometry III, also satisfies the requirements for the IAI Mathematics Major course MTH 903: Calculus III and the Engineering Major course EGR 903: Calculus III (part of three-course Calculus sequence).

For more information on the Illinois Articulation Initiative, visit their website at http://www.itransfer.org/

General Course Objectives

While learning calculus is certainly one of the goals of this course, it is not the only objective. Upon completion of this course, the student should be able to ...

- demonstrate comprehension and understanding in the topics of the course through symbolic, numeric, and graphic methods
- demonstrate the use of proper mathematical notation
- use technology when appropriate and know the limitations of technology
- work with others towards the completion of a common goal
- use deductive reasoning and critical thinking to solve problems

Specific Course Objectives

In all of the following objectives, the student should be able to think, show, and tell what is happening. Concentration will not be on the memorization of formulas but on the conceptual understanding of the calculus. Technology may be used to obtain the results, but the emphasis is on the fundamentals of calculus, not the technology.

Upon successful completion of this course, the student should be able to ...

- convert between rectangular, spherical, and cylindrical coordinate systems
- sketch three-dimensional surfaces
- find dot products, cross products, and projections using vectors
- form and work with parametric equations of lines
- distinguish the forms of the quadric surfaces
- differentiate and integrate vector valued functions
- find the arc length of a vector valued function
- find the unit tangent, normal, and binormal vectors
- find the curvature
- sketch the graph of multi-variable functions
- determine the limits of a multi-variable function
- find partial derivatives
- use the chain rule for derivatives with multi-variable functions
- determine directional derivatives and apply the gradient
- find the maximum and minimum of a multi-variable function, identify saddle values
- use the method of Lagrange multipliers to determine the extrema of a multi-variable function
- set up the regions and integrate double integrals in rectangular and polar coordinates
- set up and evaluate triple integrals
- use the Jacobian to change variables to ease integration
- find the divergence and curl
- evaluate line integrals
- determine whether a vector field is conservative and use Green's theorem
- find surface integrals
- apply Stoke's theorem

In addition to the objectives specific to this course, the student will also be expected to demonstrate mathematical reasoning and ability to solve problems using technology when appropriate.

A detailed topical outline of the content covered in this course is at the end of this syllabus.

Type of Instruction

Discussion, problem solving, activities, individual and group work, student questions, student participation, and lecture. Students are expected to have read the material before class and are strongly encouraged to come to class with a list of questions and to ask these questions.

Method of Evaluation

Could include any of the following: problem solving exams, objective exams, essays, research papers, oral presentations, group projects, individual projects, classroom activities, quizzes, and homework.

Grading Policy

Letter grades will be assigned to final adjusted scores as follows:

- A: 90 - 100%
- B: 80 - 89%
- C: 70 - 79%
- D: 60 - 69%
- F: below 60%

Consideration may be given to such qualities as attendance, class participation, attentiveness, attitude in class, and cooperation to produce the maximum learning situation for everyone.

The instructor will give you a grade sheet so that you can record your scores and keep track of your progress in the course. If you are concerned about your grades, see the instructor.

Assignments are due at the beginning of the class period on the date they are due. The instructor may be gracious and allow you to turn them in later that day without counting them late, but do not count on his graciousness. Late assignments lose 20% of their value per class period. The instructor reserves the right to apply this rule to missed exams as well as regular assignments.

Special Projects

Special projects may be included in the course requirements. These will be selected from videotape reviews, research papers, research projects, group projects, and a mathematics notebook.

Written Work

All written work should be in a typed (word processor) format. There should be a cover page with the title of the assignment and the student's name. All work should be double spaced. Papers are to be stapled together in the upper left hand corner. All reference works used, including books, videos, etc., are to be cited using APA (preferred) or MLA notation. All work is to utilize the English language correctly. It is suggested that the Student Learning Center be

utilized for assistance in the preparation of written work. If written work is submitted late, the instructor may take appropriate deductions from the grade.

Attendance Policy

Regular attendance is essential for satisfactory completion of this course. If you have excessive absences, you cannot develop to your fullest potential in the course. Students who, because of excessive absences, cannot complete the course successfully, will be administratively dropped from the class at midterm. Students whose attendance is occasional or sporadic may be dropped from the class at midterm. If a student stops attending after midterm, it is the student's responsibility to withdraw to avoid an "F". The instructor has the ability, but not responsibility, to drop students who are not regularly attending at any time during the semester. The safest way to make sure you're not dropped for non-attendance is to continue to attend classes.

The student is responsible for all assignments, changes in assignments, or other verbal information given in the class, whether in attendance or not.

If a student must miss class, a call to the instructor (RCC's phone system has an answering system) should be made or an email message sent. When a test is going to be missed, the student should contact the instructor ahead of time if at all possible. Under certain circumstances, arrangements can be made to take the test before the scheduled time. If circumstances arise where arrangements cannot be made ahead of time, the instructor should be notified and a brief explanation of why given by either voice or email. This notification must occur before the next class period begins. At the instructors discretion, the score on the final exam may be substituted for the missed exam.

Calculators

A TI-92, TI-89, or TI-Voyage calculator is highly recommended for this course. There are computers in the classroom with Derive on them, and these may be used by students who don't have the TI-92 or TI-89 calculator. Calculators may be used to do homework. Calculators may be used on exams and/or quizzes in class unless otherwise announced.

There are no calculator programs that we will be using during this class, so you do not have to have a TI calculator. However, if you have a different (Casio, Sharp, HP) graphing calculator, you will be on your own as far as figuring out how to use it.

Additional Supplies

The student should bring a pencil and calculator to class each day. You may occasionally want a ruler or graph paper. There will be a paper punch and stapler in the classroom.

Homework

Practice is necessary for successful understanding of mathematical concepts. In this class, that practice primarily takes the form of homework. There will be assigned homework problems from each of the sections. This homework should be attempted and checked before the next class period.

Homework may be collected for a grade, but even if it is not, the student should work as many problems as necessary to ensure a good understanding of the concepts.

Studies show that the average student will need to spend two hours outside of class for each hour in class. The very fact that you're in Calculus III shows that you're exceptional students, but still plan on allowing time outside of class for doing homework. Do not expect to master the subject without doing homework

Technology

In this course, we will concentrate on understanding the concepts of calculus. There will be instances when we will use the calculator or computer to aid in our understanding or remove some of the tediousness of the calculations (especially in the area of numerical approximations). There may be some projects, homework, or portions of a test that require you to use technology to complete.

Here are some of the technology tools that we will use.

TI-89/TI-92 Graphing Calculator

Many of the problems involve one step of calculus and many steps of algebra. The algebra can become quite involved and so we will be using the calculator to speed the simplification process. You should know how to do the simplification by hand, but in many cases, we'll let the calculator simplify for us.

Some of you may have a TI-82 or TI-83 calculator from an earlier class. The course can be completed with one of those calculators, but you will probably want to use Derive that is loaded on the classroom computers for symbolic manipulation.

Derive

Derive is an computer algebra system that can perform symbolic manipulation of algebraic expressions and equations. We will use Derive primarily as an aide to checking our calculations or when answers get really nasty. For the most part, you will be expected to perform the algebraic manipulations yourself. Richland has a site license for Derive version 6, but that license does not allow you to take a copy home. If you have money to burn and would like a copy, you can order it from MathWare at http://www.mathware.com/

WinPlot

WinPlot is a free graphing software package for Windows written by Rick Parris at Phillips Exeter Academy in NH. The software is useful for creating graphs and it is easy to copy/paste the graphs into other applications. You may download the software by right-clicking your mouse on the word "WinPlot" at the top of the page http://math.exeter.edu/rparris/winplot.html and choosing save.

DPGraph

DPGraph is a 3D graphing package that will be useful for visualizing the graphs of multi-variable functions. The software is not free, but Richland has a site license that allows students to download and use it without additional charge. You may download it from http://www.dpgraph.com/graphing-users.html (be sure to find the entry for Richland Community College)

Additional Help

The student is encouraged to seek additional help when the material is not comprehended. Mathematics is a cumulative subject; therefore, getting behind is a very difficult situation for the student. There are several places where you can seek additional help in your classes.

Instructor

I try to make myself as available to the students as I can. My office hours are listed at the beginning of this syllabus, but those are just the times I'm scheduled to be in my office. Grab me and ask me questions if you see me in the hallway. Ask questions before or after class. If I'm in my office and it's not my scheduled office hours, go ahead and stop in.

The instructor should be considered the authoritative source for material related to this class. If a tutor or other student says something that disagrees with the instructor, believe the instructor.

Study Groups

Probably the best thing you can do for outside help is to form a study group with other students in your class. Work with those students and hold them accountable. You will understand things much better if you explain it to someone else and study groups will also keep you focused, involved, and current in the course.

This is a small class and because of the advanced nature of the course, using each other is probably the best resource outside of the instructor that is available to you.

Student Learning Center

The Student Learning Center is located in rooms S116, S117, and S118. There is mathematics tutoring available in room S116. The Student Learning Center and the tutoring is a service that Richland Community College offers you free of charge.

Because this is an advanced mathematics course, it is unlikely that you will be able to get much help from the Student Learning Center.

Learning Accommodation Services

There are accommodations available for students who need extended time on tests, note takers, readers, adaptive computer equipment, braille, enlarged print, accessible seating, sign language interpreters, books on tape, taped classroom lectures, writers, or tutoring. If you need one of these services, then you should see Learning Accommodation Services in room C136.
If you request an accommodation, you will be required to provide documentation that you need that accommodation.

Some of you will need additional time on tests. There is no need to go to learning accommodation services to request that. If you need additional time, just let me know and in most cases, I'll allow you to continue working past the allotted time. You may need to move to another room as there may be another class coming into your room. If you're unable to finish the test by staying late, it may be possible to start the test earlier to gain additional time. There may be circumstances where extra time is not allowed.

Academic Dishonesty

Each student is expected to be honest in his/her class work or in the submission of information to the College. Richland regards dishonesty in classroom and laboratories, on assignments and examinations, and the submission of false and misleading information to the College as a serious offense.

A student who cheats, plagiarizes, or furnishes false, misleading information to the College is subject to disciplinary action up to and including failure of a class or suspension/expulsion from the College.

Non-Discrimination Policy

Richland Community College policy prohibits discrimination on the basis of race, color, religion, sex, marital or parental status, national origin or ancestry, age, mental or physical disability (except where it is a bonafide occupational qualification), sexual orientation, military status, status as a disabled or Vietnam-era veteran.

Electronic Communication Devices

The Mathematics and Sciences Division prohibits the use of cell phones, pagers, and other non-learning electronic communication equipment within the classroom. All equipment must be turned off to avoid disturbances to the learning environment. If a student uses these devices during an examination, quiz, or any graded activity, the instructor reserves the right to issue no credit for these assignments. The instructor needs to approve any exceptions to this policy.

Topical Outline

Hours	Topic
12	**Three dimensional space and vectors.** • Rectangular, spherical, and cylindrical coordinate systems • Vectors, dot and cross products, projections. • Parametric equations of lines, 3D planes, and quadric surfaces
11	**Vector valued functions** • Differentiation and integration • Arc length and change of parameters • Unit tangent, normal, and binormal vectors • Curvature, motion along a curve • Kepler's laws of planetary motion
13	**Partial Derivatives** • Multivariable graphs, contour plots • Limits and continuity • Partial derivatives, differentials • The chain rule • Directional derivatives and gradients • Tangent planes and normal vectors • Maxima and minima, Lagrange multipliers

Hours	Topic
12	**Multiple Integrals** • Double integrals in rectangular and polar coordinates • Parametric surfaces and surface area • Triple integrals in rectangular, spherical, and cylindrical coordinates • Centroid, center of gravity, theorem of Pappus • Jacobians and change of variables
12	**Topics from Vector Calculus** • Vector fields, divergence, curl • Line integrals • Independence of path, conservative vector fields, and Green's theorem • Surface integrals, flux, divergence theorem • Stoke's theorem