COLLIN COUNTY COMMUNITY COLLEGE
COURSE SYLLABUS

COURSE NUMBER: Math 2415

COURSE TITLE: Calculus III

CREDIT HOURS: 4 **LECTURE HOURS:** 3 **LAB HOURS:** 3

PREREQUISITE: Math 2414 or Math 2419

COREQUISITE: None

TEXTBOOK:

Onsite courses: Thomas' Calculus / Early Transcendentals, Eleventh Edition, Weir-Hass Giordano, ©2006, Pearson Education.

SUPPLIES: Graphing calculator required

CATALOG DESCRIPTION:

Vectors and the geometry of space, vector-valued functions and motion in space, partial differentiation, multiple integration, and integration in vector fields. Lab included.

COURSE MEASURABLE LEARNING OUTCOMES:

Upon completion of this course the student should be able to:

1. Sketch the graph of curves in two and three dimensions; in addition, sketch surfaces in three dimensions in the rectangular, cylindrical, and spherical coordinate systems.

2. Solve problems of arc length, curvature, projectile motion, and planetary motion using the properties of multi-dimensional vector-functions.

3. Solve multivariable calculus-related problems of contour mapping, rates of change, function estimation, extrema, and optimization.

4. Solve multiple integration application problems; specifically, find the volume and mass of a general solid, the inertia and centroid of a lamina and a solid, and the average value and area of a surface.

5. Use the calculus of vector fields to solve line and surface integral problems, stressing their respective relation to energy and flux problems in physics.

COURSE REQUIREMENTS:

Completion of required exams, labs, and homework.

COURSE FORMAT:

Lecture, lab and guided practice.

METHOD OF EVALUATION:

A minimum of four written exams, a lab component grade, and a comprehensive final exam. Homework and/or quizzes may be used in place of one exam or in addition to exams. The weight of each of these components of evaluation will be specified in the individual instructor's addendum to this syllabus. All out-of-class course credit, including take-home exams, home assignments, service-learning, etc. may not exceed 25% of the total course grade; thus, at least 75% of a student's grade must consist of exams given in the class or testing center, and no student may retake any of these exams.

ATTENDANCE POLICY:

Attendance is expected of all students. If a student is unable to attend, it is his/her responsibility to contact the instructor to obtain assignments. Please see the schedule of classes for the last day to withdraw from the course with a grade of W.

RELIGIOUS HOLY DAYS:

In accordance with section 51.911 of the Texas Education Code, the college will allow a student who is absent from class for the observance of a religious holy day to take an examination or complete an assignment scheduled for that day within a reasonable time. A copy of the state rules and procedures regarding holy days and the form for notification of absence from each class under this provision are available from the Admissions and Records Office.

COURSE REPEAT POLICY:

All students may repeat this course only once after receiving a grade, including W. For example, students who have taken this course twice must choose a different course to take after two trials.

ADA STATEMENT:

It is the policy of Collin County Community College to provide reasonable and appropriate accommodations for individuals with documented disabilities. This College will adhere to all applicable Federal, and State laws, regulations, and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to contact the ACCESS office (G-200) or 972.881.5898 (TDD 972.881.5950) in a timely manner if he/she desires to arrange for accommodations.

ACADEMIC ETHICS:

The college may initiate disciplinary proceedings against a student accused of scholastic dishonesty. Scholastic dishonesty includes, but not limited to, statements, acts, or omissions

related to applications for enrollment or the award of a degree, and/or the submission of material as one's own work that is not one's own. Scholastic dishonesty may involve one or more of the following acts: cheating, plagiarism, collusion, and/or falsifying academic records.

Cheating is the willful giving or receiving of information in an unauthorized manner during an examination, illicitly obtaining examination questions in advance, using someone else's work for assignments as if it were one's own, copying computer disks or files, and any other dishonest means of attempting to fulfill the requirements of a course.

Plagiarism is the use of an author's words or ideas as if they were one's own without giving credit to the source, including, but not limited to, failure to acknowledge a direct quotation. Contact Dean of Students, at 972.881.5771 for the student disciplinary process and procedures or consult the CCCCD Student Handbook.

The student will be responsible for knowing the appropriate course material to perform the tasks that are enumerated in the modules listed below.

MODULE 1: VECTORS AND THE GEOMETRY OF SPACE

The student will be able to do:

1. Plot points in the 3-D rectangular Cartesian coordinate system.
2. Calculate distance in 3-D.
3. Write a vector in component form and basis form.
4. Find the magnitude of a vector.
5. Apply the properties of vector arithmetic operations.
6. Find the dot product of two vectors and understand the properties of dot product.
7. Calculate the angle between two vectors and relate to work.
8. Determine if two vectors are orthogonal.
9. Get the orthogonal projection of one vector onto another.
10. Calculate the cross product of two 3-D vectors and understand right-hand rule.
11. Calculate torque as the cross product of a moment arm vector and a force vector.
12. Use vectors to find the area of a parallelogram and the volume of a parallelepiped.
13. Represent a line in space as a vector equation and as a set of parametric or symmetric equations.
14. Represent a plane as a vector equation and as a linear equation in x, y, and z.
15. Determine if two lines in space are intersecting, parallel, or skew.
16. Determine if two planes are parallel, perpendicular, or neither.
17. Find a plane's equation passing through three non-collinear points or two intersecting lines.
18. Find the angle between two intersecting planes or between two surfaces at a point.
19. Find the distance from a point to a plane.
20. Sketch or describe traces of functions of two variables.
21. Sketch graphs of functions of two variables, especially cylinders and quadric surfaces.

MODULE 2: VECTOR-VALUED FUNCTIONS AND MOTION IN SPACE

The student will be able to do:

1. Find the domain of a vector function.
2. Find the limit of a vector function
3. Determine where a vector function is continuous.
4. Sketch basic curves in two or three dimensions defined by vector equations.
5. Determine whether a space curve is smooth at a point.
6. Find the derivative of a vector function.
7. Find the antiderivative (integral) of a vector function, perhaps with initial conditions.
8. Given a position vector function, calculate the velocity and acceleration vector functions.
9. Find the arc length of a space curve defined by a vector equation.
10. Find the curvature of a smooth curve.
11. Solve projectile motion problems in 2-D.
12. Find the unit tangent, normal, and binormal vectors, i.e., the **TNB**-frame for a given curve.

MODULE 3: PARTIAL DERIVATIVES

The student will be able to do:

1. Evaluate multivariable functions.
2. Determine a multivariable function's domain and range.
3. Find level curves and level surfaces of multivariable functions.
4. Create a contour diagram given a basic function of two variables.
5. Evaluate limits and continuity of basic multivariable functions.
6. Calculate a partial derivative to evaluate rate of change with respect to one specific variable.
7. Approximate a partial derivative using the difference quotient.
8. Find all first-order partial derivatives of functions of several variables.
9. Find necessary higher-order partial derivatives of functions of several variables.
10. Determine the equation of the tangent plane to a surface at a given point.
11. Find the local linearization model of a function of two variables.
12. Find the total differential for a function of several variables.
13. Estimate the maximum error of one of the variables of a function using differentials.
14. Find the derivative of a composition function using the Chain Rule.
15. Calculate the rate of change of one of the variables of a multivariable function using the Chain Rule.
16. Find directional derivatives and gradients for functions of two or three variables.
17. Find critical points for functions of two variables.
18. Categorize critical points of functions of two variables as a local maximum, local minimum, saddle point, or neither using the second derivative test.
19. Find absolute (global) extrema for functions of two variables on a given domain.
20. Find critical points for multivariable functions with constraints using Lagrange Multipliers.
21. Solve applied optimization problems.

MODULE 4: MULTIPLE INTEGRALS

The student will be able to do:

1. Define a double integral of a function of two variables as the limit of a double Riemann sum.
2. Estimate a double integral of a function of two variables over a rectangular domain.
3. Find the volume under a surface by calculating a double integral.
4. Set up iterated double integrals over a defined domain.
5. Understand the conditions under which Fubini's Theorem applies.
6. Find areas of two-dimensional regions using a double integral.
7. Find the average value of a multivariable function.
8. Set up double integrals for general regions and reverse the order of integration.
9. Convert double integrals in rectangular coordinates to polar coordinates and evaluate.
10. Find volumes of solids using a double or a triple integral.
11. Find the mass and center of mass of a lamina with variable density using a double integral.
12. Find the moments of inertia and radius of gyration for a lamina using a double integral.
13. Define a triple integral of a function of three variables as the limit of a triple Riemann sum.
14. Set up and evaluate triple integrals in cylindrical and spherical coordinates.
15. Find mass and center of mass of a solid using a triple integral.
16. Find moments of inertia and radius of gyration of a solid using a triple integral.

MODULE 5: INTEGRATION IN VECTOR FIELDS

The student will be able to do:

1. Find the mass of a curved wire using a line integral.
2. Calculate work along a curved path under the influence of a force field using a line integral.
3. Sketch basic vector fields in two and three dimensions.
4. Determine if a vector field is a gradient field.
5. Find the potential function for a given conservative vector field.
6. Apply the fundamental theorem of line integrals.
7. Evaluate line integrals over a specified path directly or parametrically.
8. Define conditions under which a vector field is independent of path.
9. Evaluate line integrals of closed curves using Green's Theorem.
10. Calculate the curl and divergence of a vector field.
11. Calculate the circulation of a vector field around a simple closed curve using Curl.
12. Calculate the net rate of flow of energy across a surface or curve using Divergence.
13. Determine when a surface is positively or negatively oriented.
14. Find the area of a surface using a double integral.
15. Find the mass of a laminar surface using a surface double integral.
16. Calculate the flux of a vector field across a surface using a surface integral.
17. Evaluate surface integrals over parametrized surfaces.
18. Evaluate line integrals over simple-closed 3-D curves using Stoke's Theorem.
19. Evaluate flux integrals through Gaussian closed surfaces using the Divergence Theorem.