douglas college Course Information

A: Division: Academic

B: Department: Math and Sciences

Date: May 1993

New Course: ____

Revision of Course Information Form: x

Dated: October 1979

C: Math 321 (Subject & Course No.) D: Calculus III (Descriptive Title) E: 3 (Semester Credit)

F: Calendar Description:
This course extends the theory of differential and integral calculus to functions of several variables. Topics include the study of vectors, quadric surfaces, vector functions, cylindrical and spherical coordinate systems, partial derivatives, multiple integrals, vector fields, line integrals and applications.

Summary of Revision:

Sections D, F, I, N, O, and R

G: Type of Instruction: Hours Per Week

Lecture	4	Hrs.
Laboratory		Hrs.
Seminar		Hrs.
Clinical Experience		Hrs.
Field Experience		Hrs.
Practicum		Hrs.
Shop		Hrs.
Studio		Hrs.
Student Directed Learning		Hrs.
Other		Hrs.
TOTAL	4	Hrs.

H: Course Prerequisites: Math 220

I: Course Corequisites: Math 232 is recommended

J: Course for which this course is a prerequisite: Math 421 and 440

K. Maximum Class Size: 35

L: College Credit Transfer: x

College Credit Non-Transfer: ____

M Transfer Credit:
Requested ____
Granted x

Specify Course Equivalents or Unassigned Credit as Appropriate

U.B.C. Math 200(3)
S.F.U. Math 251(3)
U. Vic. Math 200(1.5)
Other:

Susan Hamm
COURSE DESIGNER(S)

[signature]
DIVISIONAL DEAN

[signature]
DIRECTOR/CHAIRPERSON

P.H. [signature]
REGISTRAR

N: Textbooks and materials to be Purchased by Students:

Stewart, James. Multivariable Calculus , Brooks/Cole Publishing Company, 1991.

O. Course Objectives:

Upon completion of Math 321 the student should be able to:

- use vector notation and the properties of vectors
- use vectors to represent force and velocity
- compute dot and cross-products and verify and use the properties of these products
- determine whether vectors are parallel, orthogonal, or neither, and in the latter case determine the angle between the two vectors
- find the direction cosines and the direction angles of given vectors
- find scalar and vector projections of one vector onto another and apply this to the solution of work problems
- use the cross-product to determine areas of parallelograms
- use the scalar triple product to find the volume of a parallelepiped
- find vector, parametric and symmetric equations of a line in R^3 given two distinct points on the line or a point on the line and a vector that is parallel to it
- determine whether two lines are parallel, perpendicular or skew
- determine whether planes are parallel, perpendicular or neither, and in the latter case, find the angle between them
- find both the vector and the scalar equation of a plane in R^3, given a point in the plane and the normal vector or three non-collinear points in the plane
- determine points of intersection between two lines or between a line and a plane and the line of intersection between two planes (optional)
- find the distance between a point and a plane and a point and a line (optional)
- given a second-degree equation in three variables, identify the quadric surface it represents, find its traces in the x-, y- and z- planes and sketch its graph
- sketch regions bounded by more than one quadric surface
- determine the limit of vector functions
- determine where a vector function is continuous
- sketch graphs of vector functions
- differentiate and integrate vector functions
- find unit tangent vectors and tangent lines to curves described by vector functions
- verify differentiation rules for vector functions
- find the length of a curve in space that is described by a vector function
- determine the curvature of a curve
- find the principal unit normal vector
- apply the above to problems of motion in space, specifically velocity and acceleration
- use the cylindrical and spherical coordinate systems to describe curves and regions
- convert the equation of a curve or region between rectangular, spherical and cylindrical coordinates
- sketch graphs of functions of two variables
- sketch level curves of functions of two variables
- sketch level surfaces for functions of three variables
- determine limits of functions of two or three variables or prove that the limits do not exist
- determine where a function of two or three variables is continuous
- calculate partial derivatives
- find the equation of the tangent plane to a surface at a point
- use differentials to approximate values and error for functions of two or three variables
- establish and apply the chain rules
- find derivatives for implicitly defined functions
- find directional derivatives and gradients of functions
- find the maximum value of the directional derivative
- find critical points and use the second derivative test to classify extrema and saddle points of surfaces
- use the above to solve optimization problems
- use the method of Lagrange Multipliers to find the maximum/minimum values of functions subject to given constraints

- set up double or triple Riemann sums as appropriate given a function and a rectangular region of integration and convert these to multiple integral notation
- calculate iterated integrals and double integrals over rectangular regions
- calculate double integrals over general regions in rectangular or polar coordinate systems, changing the order of integration if necessary
- convert a double integral from rectangular to polar coordinates or vice versa
- calculate triple integrals over general regions
- convert triple integrals from orthogonal coordinates to cylindrical or spherical coordinates
- calculate the Jacobian and perform a change in variables in a multiple integral given by a transformation
- use the above integration techniques to find areas of regions, volumes of solids, and areas of surfaces, as well as to solve problems involving physical applications such as mass, electric charge, center of mass and moments of inertia
- sketch a vector field on R^2
- find the gradient vector field of a multi-variable function
- evaluate a line integral of a function along a curve with respect to the arclength and also with respect to its independent variables, and apply this to the solution of problems involving mass, and center of mass
- evaluate line integrals of vector fields
- determine whether or not a vector field is conservative, and if it is determine its potential function
- show that a line integral is independent of path and evaluate the integral

P. Course Content:

1. Three-dimensional coordinate systems: orthogonal, cylindrical and spherical, quadric surfaces

2. Vectors: dot and cross products, lines and planes, vector functions and space curves, arclength, curvature, velocity and acceleration

3. Partial Derivatives: limits and continuity, tangent planes and differentials, the chain rule, directional derivatives and the gradient vector, optimization, Lagrange multipliers

4. Multiple Integrals: double integrals over general regions in rectangular and in polar coordinates, applications of double integrals including mass, moments of inertia and surface area, triple integrals in orthogonal, cylindrical and spherical coordinate systems, change of variables in multiple integrals

5. Vector Calculus: line integrals, Fundamental theorem for line integrals

Q. Method of Instruction:

Lectures, problem sessions and assignments.

R. Course Evaluation:

Evaluation will be carried out in accordance with Douglas College policy. The instructor will present a written course outline with specific evaluation criteria at the beginning of the semester. Evaluation will be based on some of the following:

1. Weekly quizzes	0 - 40 %
2. Tests	20 - 70 %
3. Assignments	0 - 15 %
4. Attendance	0 - 5 %
5. Class participation	0 - 5%
6. Final Examination	30%