EFFECTIVE: MAY 2006

CURRICULUM GUIDELINES

Douglas College

A.	Division:	Academic Division	Effective Date:	May 2006
B.	Department / Program Area:	Mathematics / Science & Technology	Revision [X]	New Course [ ]
			If Revision, Section(s) Revised:	D, F, G, H, I, K, M, N, O, P, Q
			Date of Previous Revision:	September 2004
			Date of Current Revision:	August 2005

Subject & Course No.	Descriptive Title	Semester Credits
C: MATH 2440	**D:** Calculus IV	**E:** 3

F: Calendar Description:

This is a course in vector calculus that applies calculus to vector functions of a single variable as well as scalar and vector fields. Topics include gradient, divergence, curl; line, surface and volume integrals; the divergence theorem as well as the theorems of Green and Stokes.

G: Allocation of Contact Hours to Type of Instruction / Learning Settings

Primary Methods of Instructional Delivery and/or Learning Settings:

Lectures/tutorials

Number of Contact Hours: (per week / semester for each descriptor)

Lectures: 4 hrs/week
Tutorials: 1 hr/week

Number of Weeks per Semester:

15

H: Course Prerequisites:

MATH 2321

I: Course Corequisites:

MATH 2232 (recommended)

J: Course for which this Course is a Prerequisite

None

K: Maximum Class Size:

35

L: PLEASE INDICATE**:**

- [ ] Non-Credit
- [ ] College Credit Non-Transfer
- [X] College Credit Transfer:

SEE BC TRANSFER GUIDE FOR TRANSFER DETAILS (www.bctransferguide.ca)

M: Course Objectives / Learning Outcomes

At the completion of the course a student will be expected to:

- Perform basic vector operations such as addition, subtraction, multiplication by a scalar, as well as find the magnitude of a vector
- Find a unit vector in the same direction as a given vector
- Use vectors to solve geometric problems and problems involving lines and planes in R^3
- Use, and understand the geometric significance of, the scalar, vector, and triple scalar products in problem solving
- Find the orientation of vectors via the right-hand rule
- Prove various vector identities
- Use tensor notation to simplify vector expressions
- Apply the concepts of the limit and differentiation to vector-valued functions
- Reparametrize space curves, especially in terms of arc length; find the unit tangent vector to a given space curve
- Find the velocity and (the tangential and normal components of) the acceleration of a particle moving along a space curve; find the curvature and torsion of a space curve
- Apply polar, cylindrical and spherical coordinates to solve problems involving space curves
- Determine, and solve problems using, the gradient of a scalar field; interpret the practical significance of the gradient of a scalar field and isotimic (level) surfaces
- Find the equations of flow lines for a given vector field
- Calculate and interpret geometrically the divergence and curl of vector fields; represent gradient, divergence, and curl using del (nabla) notation
- Calculate the laplacian of scalar and vector fields
- Verify vector operator identities with and without tensor notation
- Compute grad, div, curl and laplacian in cylindrical, spherical and general orthogonal curvilinear coordinates
- Calculate line integrals; interpret them especially in terms of work done
- Determine if a region is a domain and, if so, whether it is simply connected
- Utilize the concept of an irrotational vector field to determine if the field is conservative; find a potential function for a conservative vector field
- Determine if a vector field is solenoidal and, if so, find a corresponding vector potential in simple cases
- Construct a parametric representation of a surface and find the unit normal to the surface either parametrically or nonparametrically
- Compute a given surface integral directly; give an interpretation for the surface integral
- Compute a given volume integral
- Utilize the divergence theorem to evaluate given integrals; interpret the practical meaning of the divergence theorem
- Prove various statements involving Green's formulae and the Fundamental Theorem of Vector Analysis
- Use Green's theorem to find particular areas and evaluate given line integrals
- Utilise Stokes' theorem to evaluate given integrals; interpret the practical meaning of Stokes' theorem
- Optional: Use dyadics to compute Taylor polynomials, verify the flux and Reynold's transport theorems

N: Course Content:

1. Review of vector algebra, scalar and vector fields; tensor notation, acceleration, curvature, Frenet formulae.
2. Scalar and vector fields; gradient, divergence, curl, laplacian; cylindrical, spherical, orthogonal curvilinear coordinates.
3. Line, surface and volume integrals; simply connected domain; conservative and solenoidal fields and their potential; orientable surfaces and surface integrals; volume integrals.
4. The divergence theorem and Stokes' theorem and their applications and consequences; the Fundamental Theorem of Vector Analysis and Green's theorem.

Optional: Transport theorems.

O: Methods of Instruction

Lecture, problems sessions, written and computer exercises.

P: Textbooks and Materials to be Purchased by Students

Davis and Snider. Introduction to Vector Analysis, Seventh Edition, Hawkes, 1995.

Q: Means of Assessment

Quizzes	0 – 40 %
Term Tests	20 – 70 %
Assignments	0 – 20 %
Attendance	0 – 5 %
Participation	0 – 5 %
Tutorial activities	0 – 10 %
Final Examination	30 – 40 %

R: Prior Learning Assessment and Recognition: specify whether course is open for PLAR

None

Course Designer(s) Wesley Snider

Education Council / Curriculum Committee Representative

Dean / Director Des Wilson

Registrar Trish Angus