UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 377 Vector Calculus for Engineers and Scientists

Calendar Description: H(3-1.5T)

Review of calculus of functions of several variables. Vector fields, line integrals, independence of path, Green's theorem; Surface integrals, divergence theorem, Stokes's theorem; applications; curvilinear coordinates; Laplace, diffusion and wave equations in three dimensional space.

Prerequisite(s): Math 375

Antirequisite(s): Credit for more than one of Mathematics 377, 331, 353, 367, 381 or Applied Mathematics 309 will not be allowed.

Syllabus

Topics	**Number of Hours**
Review of vector functions and multiple integration	7
Line integrals and surface integrals	7
Gradient, curl, divergence, Green's theorem, divergence theorem, Stokes's theorem	9
Partial differential equations of mathematical physics	9
Orthogonal curvilinear coordinate systems	5
TOTAL HOURS	**37**

See accompanying page for a detailed breakdown of instructional hours.

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MATH 377 Vector Calculus for Engineers and Scientists

Review of Vector Functions :	
Vector Functions of One variable.	1 Hour
Curves and Parametrization,	2 Hours
Review of Multiple Integration :	
Double Integrals , Triple Integrals	4 Hours
Vector Fields :	
Vector and Scalar Fields.	1 Hour
Conservative Fields	1 Hour
Line Integrals.	1 Hour
Line Integrals of Vector Fields.	1 Hour
Surfaces and Surface Integrals.	1 Hour
Oriented Surfaces and Flux Integrals.	1 Hour
Vector Calculus : (16.1 - 16.6)	
Gradient , Divergence , and Curl.	2 Hours
Some Identities Involving Grad , Div , and Curl.	1 Hour
Green's Theorem in the Plane.	1 Hour
The Divergence Theorem in 3-Space.	1 Hour
Stokes's Theorem.	2 Hours
Some Physical Applications of Vector Calculus.	2 Hours
Partial Differential Equations of Mathematical Physics:	
The three dimensional Laplace equation	3 Hours
The three dimensional wave equation	3 Hours
The three dimensional Heat equation	3 Hours
Orthogonal Curvilinear coordinate systems:	
Coordinate surface and coordinate curves	1 Hour
Scale factors and differential elements	1.5 Hours
Gradient , Divergence , Curl and Laplacian in orthogonal curvilinear coordinates	1.5 Hours
Application to velocity and acceleration	1 Hour

Total: 37 Hours

MATH 377: Vector Calculus for Engineers and Scientists

COURSE OUTCOMES

Upon Successful Completion of the Course, Students will be able to:

1. Adapt to the terminology, vocabulary of vector calculus and recognize wide range of symbols it employs;

2. Develop proficiency on the key concepts of vector calculus and use them to compute
   Line, Surface, and Flux Integrals of Scalar and/or vector fields of several variables;

3. Use available tools such as the Divergence Theorem , Stokes's Theorem and Orthogonal Curvilinear Coordinates to significantly reduce the complexity of calculations of multiple integrals;

4. Apply vector calculus techniques to solve and analyze wide variety of Physical applications in interdisciplinary fields including but not limited to Fluid Dynamics, Electromagnetism, Electrostatics, Maxwell's Equations of modern electrical and communications technologies. etc.

5. Explore the relationship between key vector calculus concepts, and their geometric implications for an enhanced interpretation of certain physical or natural phenomena.

6. Use Double Fourier Series to obtain solutions to the most frequent equations of Mathematical Physics (Heat, Wave and Laplace Equations) in two or more Space variable.