Douglas College

EFFECTIVE: SEPTEMBER 2004
CURRICULUM GUIDELINES

A.	Division:	**Academic Division**	Effective Date:		**September 2004**	
B.	Department / Program Area:	**Mathematics / Science & Technology**	Revision	**X**	New Course	
			If Revision, Section(s) Revised:		**C, H, I, O**	
			Date of Previous Revision:		**November 1982**	
			Date of Current Revision:		**September 2004**	

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

F: Calendar Description:

Potential theory examines the mathematics of the physical concept of potential energy, and develops a mathematical model of simple fluid flows and electromagnetic fields by applying the differential and integral calculus to the analysis of vector spaces.

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

Primary Methods of Instructional Delivery and/or Learning Settings:

Lectures/Seminar

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

Lectures: 3 hrs/week
Seminar: 1 hr/week

Number of Weeks per Semester:

15

H: Course Prerequisites:

MATH 2321 (Calculus III)

I: Course Co requisites:

MATH 2232 (Linear Algebra)

J: Course for which this Course is a Prerequisite
Related courses:
Physics PHYS 420 (Electro-magnetic theory)

K: Maximum Class Size:

L: PLEASE INDICATE**:**

	Non-Credit
	College Credit Non-Transfer
X	College Credit Transfer:

SEE BC TRANSFER GUIDE FOR TRANSFER DETAILS (www.bccat.bc.ca)

M: Course Objectives / Learning Outcomes

1. Represent curves parametrically; define tangent and principle normal; define and compute $\int_{\ell} f(\underset{\sim}{x})ds$; $\iint_{A\subset\mathbb{R}^2} f(\underset{\sim}{x})\, dA$; $\iiint_{V\subset\mathbb{R}^3} f(\underset{\sim}{x})\, dV$

    1.1. Review change of variables. Differentiate expressions involving $\cdot$, x, $|\ |$ $|\ |$, etc.

2. Represent surfaces parametrically; define tangent plane and normal; define and compute $\iint_{S} f(\underset{\sim}{x})\, dA$.
3. Recognize application of scalar and vector fields in the study of temperature, pressure, heart and fluid flow, etc. Define gradient and relate to tangent plane and physical ideas. Sketch equi-potentials and stream lines for given potentials or fields.
4. Define $\int_{\ell} \underset{\sim}{F}(\underset{\sim}{x})\cdot d\underset{\sim}{s}$ and interpret as work or flow. Recognize the dependence on ℓ.

    4.1. Investigate entropy and the state function concept, and the notion of kinetic and potential energy. Define potential and conservative field. State and prove the standard results concerning existence of potential, invariance under change of path, and integrals over closed paths in rectangular regions.

5. Define $\int_{\ell} \underset{\sim}{F}(\underset{\sim}{x})\cdot d\underset{\sim}{n}$ and $\iint_{S} \underset{\sim}{F}(\underset{\sim}{x})\cdot d\underset{\sim}{A}$ and interpret as flows.
6. Define divergence in a coordinate-free manner; derive the Cartesian formulae in $\mathbb{R}^2$ and $\mathbb{R}^3$ and recognize the physical significance of divergence.
7. Define curl in a coordinate-free manner and derive the Cartesian formulae in $\mathbb{R}^2$ and $\mathbb{R}^3$; recognize the physical significance of curl and investigate vortices.
8. State and prove elementary forms of Gauss', Stokes' and Green's theorems. Describe the physical ideas conveyed by these theorems. Use them to evaluate integrals for areas and volumes etc.
9. Obtain polar-coordinate expressions for gradient, divergence and curl.
10. Discuss situations described by the equations of Laplace and Poisson; obtain Cartesian polar representations for the Laplacian.
11. Deduce and use common vector identities.

N: Course Content:

O: Methods of Instruction

The class meets four times a week for fourteen weeks.

There is a problem assignment each week; some time will be spent in class going over these problems or others of a similar nature if there is a sufficient demand, but it is expected that most questions will be resolved outside class time through consultation with the instructor.

MATH 2232 (Linear Algebra) is one of the co-requisites for this course; vector notation will be used freely and whenever appropriate in this course.

P: Textbooks and Materials to be Purchased by Students

Q: Means of Assessment

The final letter grade for the course will be based on:

- Three test during the course of the semester
- A comprehensive, three hour final examination

If it is in the student's advantage, the scores on the three tests will be ignored in arriving at the course grade.

Since this course is pre-requisite to most further courses in mathematics, a satisfactory score must be obtained on the final examination if a grade higher than P is to be awarded for the course.

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