DOUGLAS COLLEGE

COURSE INFORMATION

DEPARTMENT MATHEMATICS AND SCIENCES DATE NOVEMBER 1982

NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	SEMESTER HOURS CREDIT
MAT 440	POTENTIAL THEORY	3

CATALOGUE 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.

COURSE PREREQUISITES: MAT 321 (Calculus III)

COURSE COREQUISITES: MAT 232 (Linear Algebra)

HOURS PER WEEK FOR EACH STUDENT.

LECTURE 3 HRS.
LABORATORY ___ HRS.
SEMINAR 1 HRS.

FIELD EXPERIENCE ___
STUDENT DIRECTED LEARNING ___
OTHER (SPECIFY) ___

TOTAL 4

COLLEGE CREDIT TRANSFER [x] COLLEGE CREDIT NON-TRANSFER [ ] NON-CREDIT [ ]

TRANSFER INFORMATION

EQUIVALENT COURSES

UBC Math 201; Math 150 (with 321)
SFU Math 252
OTHER

UNASSIGNED CREDIT
(specify if unassigned within a discipline or a faculty)

COURSE DESIGNER JOHN A. HAZELL

DEAN OF ACADEMIC DIVISION

DEPARTMENT HEAD

Andrew J. Wilson Feb. 22, 1983

~~PRINCIPAL~~ REGISTRAR

Form C-1(Revised April'72)

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COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:
	Physics PHY420 (Electro-magnetic theory)

TEXTBOOKS, REFERENCES, MATERIALS (LIST READING RESOURCES ELSEWHERE)

COURSE OBJECTIVES, CONTENT, METHOD, EVALUATION:

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

   Review change of variables. Differentiate expressions involving $\cdot$, $\times$, $\|\ \|$, 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, heat 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.

   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. Investigate sources and sinks.

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.

METHOD AND EVALUATION

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.

MAT 232 (Linear Algebra) is one of the co-requisites for this course; vector notation will be used freely and whenever appropriate in this course.

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

- three tests during the course of the semester
- a comprehensive, three hour final examination

If it is to 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.

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