UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics **REVISION DATE:** March 1994

Math 310 (formerly Math 213)	Ordinary Differential Equations	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

Whenever an investigator attempts to make a model of a system, whether it is from biology, physics, economics, sociology or psychology, in most cases that mathematical model is in the form of a differential equation. This course examines some methods of solving certain types of differential equations. Topics will include first-order differential equations and applications, linear differential equations and applications, series solutions and Laplace transform methods. Additional topics may include systems of linear differential equations, approximation techniques, phase plane analysis.

COURSE PREREQUISITES: Math 211 with C or better, Math 221

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	Lecture	60 hrs	Student Directed Learning		hrs
	Laboratory	hrs	Other - specify:		
	Seminar	hrs			hrs
	Field Experience	hrs	TOTAL	60	HRS

[X] UCFV CREDIT TRANSFER UCFV CREDIT NON-TRANSFER NON-CREDIT

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC Math 215 (3)

SFU Math 310 (3)

UVIC Math 201 (1.5)

UNBC

OLA Math 411 (3)

Math Curriculum Committee — COURSE DESIGNER

J.D. TUNSTALL Ph.D. — DEAN OF ACADEMIC STUDIES

OUTLN93/12/DD

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COURSES FOR WHICH THIS IS A PREREQUISITE:	**RELATED COURSES**

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:

A First Course in Differential Equations with Applications, by D.G. Zill, 5th Ed.

REFERENCES:

Elementary Differential Equations with Applications, 3rd Ed., Derrick/Grossman, Addison Wesley, 1981.

OBJECTIVES:

- **solve first order differential equations**
- **use numerical methods**
- **apply the methods of undetermined coefficient and variation of parameters**
- **apply Laplace transform methods**
- **apply power series methods**
- **use all of the above techniques in solving problems arising from physics, chemistry, biology, economics, and engineering**

METHODS:

Traditional lectures with tutorial sessions.

STUDENT EVALUATION PROCEDURE:

Midterm exams	**40%**
Assignments	**20%**
Final exam	**40%**

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COURSE CONTENT

1. **First Order and Simple Higher Order O.D.E.'s**
   - a. Exact differential equations, integrating factors, Separation of variables
   - b. First order linear equation
   - c. Homogeneous equation
   - d. Method of inspection
   - e. Higher order integrable equations, Reductions of order

2. **Numerical Methods**
   - a. Direction Fields, flow lines
   - b. Euler Methods
   - c. 3-term Taylor
   - d. Runge - Kutta
   - e. The use of MAPLE in numerical solutions calculations

3. **Applications of First-Order and Simple Higher-Order Equations**
   - a. Mechanics, Newton's Law of Motion
   - b. Electric circuits, Kirchoff's Law
   - c. Orthogonal trajectories
   - d. Steady-State heat flow
   - e. Growth and decay
   - f. Compartmental Analysis

4. **Linear Differential Equations**
   - a. Existence and uniqueness of solutions
   - b. Preliminary theory
   - c. Homogeneous equations with Constant Coefficients
   - d. Method of Undetermined Coefficients
   - e. Method of Variation of Parameters
   - f. Cauchy-Euler equation

5. **Applications of Linear Equations**
   - a. Vibrational models of mechanical systems SHM, damped motion, forced motion
   - b. Electric circuits and other Analogous Systems

6. **Series Solutions**
   - a. Review of Power Series
     Convergence, Generating Power Series, Algebraic operations, Integration and Differentiation
   - b. Series Solutions about ordinary points
   - c. Method of Frobenius, Solutions about singular points
   - d. Bessel's equation, Legendre's Equation, Bessel Functions and Legendre Polynomials

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COURSE CONTENT (cont'd)

7. Laplace Transforms
- **a. The Laplace transform, Sufficient Conditions**
- **b. Inverse Laplace transforms**
- **c. Special Methods, Translation Theorems, Derivatives of a Transform, Heaviside Functions**
- **d. Transforms of Derivatives, Integrals and Periodic Functions**
- **e. Convolution Theorems**
- **f. Dirac Delta Functions**
- **g. Applications including Integral Equations**

8. Other (optional)
- **a. Fourier Series, Fourier transforms**
- **b. Simultaneous differential equations**