EFFECTIVE: MAY 2003

Douglas College

CURRICULUM GUIDELINES

A.	Division:	Instructional	Effective Date: June 30, 2002		
B.	Department / Program Area:	Math	Revision	X	New Course ☐
			If Revision, Section(s) Revised:		F,G,M,N,O,P,Q
			Date of Previous Revision:		May 1994
			Date of Current Revision:		

C: Math 421 — **D**: Introduction to Differential Equations — **E:** 3

Subject & Course No.	Descriptive Title	Semester Credits
Math 421	Introduction to Differential Equations	3

F: Calendar Description: Calendar Description: This is a first course in ordinary differential equations. Topics include the theory and applications of linear and non-linear ordinary differential equations (ODE's) and systems of ODE's. Formal solution methods are investigated as well as power series, Laplace transform, matrix and numerical/computer methods. Qualitative and asymptotic properties of an equation or system are studied by way of phase plane and/or stability analysis.

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

Lecture	3 – 4 hours/week
Tutorial/Lab	0 –1 hours/week

Primary Methods of Instructional Delivery and/or Learning Settings:

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

4

Number of Weeks per Semester:

15

H: Course Prerequisites: Math 220 and Math 232 or special permission

I: Course Corequisites: None

J: Course for which this Course is a Prerequisite

None

K: Maximum Class Size: 35

L: PLEASE INDICATE**:**

☐	Non-Credit	SFU 310(3)	Uvic 201(1.5)
☐	College Credit Non-Transfer	UBC 215(3)	UNBC 332(3)
X	College Credit Transfer:	UBC 255(3)	

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

M: Course Objectives / Learning Outcomes

Upon completion of this course a student will be expected to:

- identify and solve first order separable, homogeneous, exact, linear, Bernoulli and Ricatti equations
- determine the existence and uniqueness of a solution of a first order initial value problem
- determine families of solution curves and their orthogonal trajectories

- set up and solve differential equations involving motion, population growth, chemical reactions/mixing, electrical circuits etc.
- determine whether or not a set of function is linearly independent. Understand and use the properties of the Wronskian
- reduce the order of a higher order DE from the information of a known solution
- identify and solve homogeneous linear constant coefficient DE's and Cauchy-Euler DE's
- use differential operator notation to express DE's
- solve non-homogeneous DE's using method of undetermined coefficients and variation of parameters
- analyze and describe all aspects of harmonic motion; damping, resonance, forced motion
- use power series to find representations for solutions of a DE near an ordinary point
- use the method of Frobenius to solve DE's near regular singular points (optional)
- use the definition of the Laplace transform to verify its properties
- determine Laplace transforms of simple functions, derivatives, integrals, step and impulse functions
- with the use of tables, determine inverse Laplace transforms
- use convolution and translation theorems to find Laplace transforms and their inverses
- solve and verify properties of DE's using Laplace transforms
- solve systems of DE's using Laplace transforms or operator techniques
- reduce a higher order linear DE to a first order linear system of DE's
- find eigenvalues and eigenvectors of a square matrix
- use matrix methods to solve first order autonomous linear systems of DE's
- find stationary point(s) of a DE
- determine the stability of a solution near a stationary point
- analyze and discuss trajectories in the phase plane
- generate analytical, graphical or numerical output from a computer algebra system (MAPLE) to assist in the analysis of a DE

N: Course Content:

1. First Order Differential Equations: separable, homogeneous, exact, linear, Bernoulli and Ricatti equations and applications.
2. Higher Order Linear Differential Equations: General theory, reduction of order, homogeneous constant coefficient and Cauchy-Euler equations, undetermined coefficients and variation of parameters methods for non-homogeneous equations.
3. Power Series: Variable coefficients, method of Frobenius, Bessel and Legendre's equations.
4. Laplace Transforms: Properties applied to solving DE's.
5. Systems of Linear Differential Equations: Equivalence of n-th order linear DE's to an $n \times n$ linear system of DE's. Laplace, operator and matrix methods. Phase plane analysis.
6. Non-linear Systems and Stability: solution trajectories of autonomous systems, stationary points and stability near a stationary point. Phase plane analysis

O: Methods of Instruction

Lecture, problem sessions/assignments and technology (computer) laboratory assignments.

P: Textbooks and Materials to be Purchased by Students

Zill, Dennis. **A First Course in Differential Equations with Modeling Applications 7th ed**, Brooks/Cole, 2001.

Q: Means of Assessment

Quizzes	0 – 40 %
Term Tests	20 – 70 %
Assignments	0 – 20 %
Computer Labs	0 – 20 %
Attendance	0 – 5 %
Class Participation	0 – 5 %
Final Examination	30 – 40 %

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

None

Course Designer(s)

Education Council / Curriculum Committee Representative

Dean / Director

Registrar