UNIVERSITY COLLEGE of the FRASER VALLEY

COURSE IMPLEMENTATION DATE: September 2005
COURSE REVISED IMPLEMENTATION DATE:
COURSE TO BE REVIEWED: September 2009
(Four years after implementation date) (MONTH YEAR)

OFFICIAL COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Science, Health & Human Services / Mathematics & Statistics**

MATH 415		**3**
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Ordinary Differential Equations II
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course will study qualitative properties of differential equations and systems of differential equations. Topics include existence and uniqueness theorems for nonlinear systems, iterative techniques to approximate solutions, oscillation and comparison theorems for second-order linear equations, matrix techniques for linear systems, diffeomorphisms for nonlinear systems, and Lyapunov functions.

PREREQUISITES: **MATH 211, MATH 214, MATH 255, and one of MATH 152 or MATH 221.**
COREQUISITES:

SYNONYMOUS COURSE(S)
(a) Replaces: _____ *(Course #)*
(b) Cannot take: _____ *(Course #)* For further credit.

SERVICE COURSE TO:
(Department/Program)
(Department/Program)

TOTAL HOURS PER TERM: **60**
STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field Experience:		Hrs
Student Directed Learning:		Hrs
Other (Specify):		Hrs

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT: **36**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **Every second year**

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

AUTHORIZATION SIGNATURES:

Course Designer(s): Erik Talvila
Chairperson: Gillian Mimmack *(Curriculum Committee)*
Department Head: Gillian Mimmack
Dean: Jacalyn Snodgrass
PAC Approval in Principle Date:
PAC Final Approval Date: April 29, 2005

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

On completion of the course, the successful student will be able to:

1. Prove existence for first order nonlinear systems under conditions of continuity;
2. Prove uniqueness under Lipshitz continuity;
3. Prove the Sturm separation and comparison theorems;
4. Determine qualitative properties of zeroes of solutions using the above two theorems;
5. Use diffeomorphisms to analyse local behaviour of nonlinear systems.
6. Construct Lyapunov functions to prove stability.
7. Convert a differential equation to an equivalent integral equation and solve by Picard iteration.

Students will extend and generalize the concepts covered in MATH 255.

METHODS:

This course will be primarily lecture based.

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

METHODS OF OBTAINING PLAR:

Course challenge. Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

The textbook is chosen by a departmental curriculum committee. Recommended texts are:

V.I. Arnol'd. Ordinary differential equations. Springer-Verlag.
G. Birkhoff and G.-C. Rota, Ordinary differential equations. Wiley.
M.W. Hirsch and S. Smale. Differential equations, dynamical systems, and linear algebra. Academic Press.
G.F. Simmons. Differential equations with applications and historical notes. McGraw-Hill.

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

Assignments	40%
Term Tests	20%
Final Exam	40%

Students must obtain at least 40% on the final exam in order to pass the course.

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

1. Existence theorem, Lipshitz condition, uniqueness theorem for first order nonlinear systems.
2. Sturm oscillation and separation theorems for approximate behaviour of zeroes of second order linear eqations.
3. Matrix methods for linear systems, exponential of a matrix, classification of critical points using eigenvalues.
4. Study of critical points of nonlinear systems by diffeomorphism to linear systems.
5. Lyapunov functions, energy estimates.
6. Equivalent integral equations, Picard iteration, contraction mappings.