Western University Course Outline
Applied Mathematics 3813b, Winter 2016
Nonlinear differential equations and chaos

Instructor: Dr. Greg Reid **Office:** MC 281
email: reid@uwo.ca **Tel:** 679-2111 Ext. 88793
lectures: WSC 248, M W F 10:30am – 11:30am (note the updated location)
Web: (Sakai): owl.uwo.ca (check it at least 4.44 times a week)

Text: *AM3813b Nonlinear Differential Equations and Chaos*, by P. Yu and C. Essex, available on line in .pdf format. Full details available in class. Other supplementary materials will be supplied by the instructor.

Prerequisites: Applied Mathematics 2402A or the former Differential Equations 2402A; Calculus 2303A/B or 2503A/B and Mathematics 1600A/B or the former Linear Algebra 1600A/B.

Contents of Course:

Chaos and nonlinearity is a topic that is modern, beautiful and useful. Fundamental techniques, linearizing nonlinear systems, and computing stability using eigenvectors and eigenvalues, are taught and are fundamental in the course. This course takes the student to the forefront of ideas in modern applied mathematics. Particular emphasis is placed on student creativity and exploration of ideas using modern tools. The course is designed to be accessbile to a wide variety of students.

Existence and uniqueness of solutions, phase space, singular points, stability, periodic attractors, Poincar-Bendixson theorem, examples from physics, biology and engineering, frequency (phase) locking, parametric resonance, Floquet theory, stability of periodic solutions, strange attractors and chaos, Lyapunov exponents, chaos in nature, fractals.

Maple (and occasionally Matlab) will be used throughout the course. Prior knowledge of programming is not required, although the student should have had some experience with using a computer package (e.g. Maple, Matlab or Mathematica). Students are expected to develop their ability to write solutions and this will be a component of assessment (i.e. English description, rather than just formulae).

Evaluation (in Draft Form):
Some marks will be given for *style*: with particular emphasis on verbal expression, brevity and clarity.
bonus points: occasionally challenge problems will be posed.
Approximately 4 hand-in assignments and 3 quiz(25%),
Project(30% or 20%) **Final Exam**(45% or 55%).

The weights will be chosen that give you the highest percentage for the course.

Graded assignments and quizzes will all be equally weighted. There will be no make-ups on missed quizzes or assignments. However, you will be able to drop lowest score. Please let me know of legitimate reasons for missing quiz/assignments with appropriate documentation at the time they occur. Some Maple related questions can occur on quiz/tests/assigns.

The fine print – Addendum to all Applied Mathematics Course Outlines
The UWO Senate Academic Handbook has specified that the following points should be added to all course outlines:
A. Prerequisites: Applied Mathematics 2402A or the former Differential Equations 2402A; Calculus 2303A/B or 2503A/B and Mathematics 1600A/B or the former Linear Algebra 1600A/B.
B. Medical/Compassionate Excuses: Students missing work for valid medical or other reasons are governed by the regulations `https://studentservices.uwo.ca/secure/index.cfm`
C. Accessibility Statement: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation. If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your faculty's Dean's Office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from your faculty's Dean's Office immediately.
D. Calculators: No calculators on Quiz or Final.
E. Academic Offences: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: // `http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf`
F. Plagiarism on Term Paper: All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (`http://www.turnitin.com`).
G. Support Services: Support is available from the Registrar: `http://www.registrar.uwo.ca`, via the university students council (`http://westernusc.ca/services/`) and at Student Development Services (`http://www.sdc.uwo.ca/`).
H. Mental or Emotional Health: Students who are in emotional/mental distress should refer to Mental Health@Western `http://www.uwo.ca/uwocom/mentalhealth/` for a complete list of options about how to obtain help.