FLORIDA ATLANTIC UNIVERSITY™

Graduate Programs—NEW COURSE PROPOSAL

UGPC APPROVAL _____
UFS APPROVAL _____
SCNS SUBMITTAL _____
CONFIRMED _____
BANNER POSTED _____
ONLINE _____
MISC _____

DEPARTMENT NAME:
MATHEMATICAL SCIENCES

COLLEGE OF:
CHARLES E. SCHMIDT COLLEG E OF SCIENCE

RECOMMENDED COURSE IDENTIFICATION:

PREFIX _____MTG_____ **COURSE NUMBER** ___6418_____ **LAB CODE** (L or C) _____

(*TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU)*

COMPLETE COURSE TITLE

DYNAMICAL SYSTEMS, CHAOS AND COMPUTING

EFFECTIVE DATE
(first term course will be offered)

_____

CREDITS:
3

TEXTBOOK INFORMATION:
H-O PEITGEN, H. JURGENS AND D. SAUPE, CHAOS AND FRACTALS: NEW FRONTIERS OF SCIENCE, SPRINGER 1993. ISBN-13: 978-0387979038.

GRADING *(SELECT ONLY ONE GRADING OPTION)*: **REGULAR** ___X__ **PASS/FAIL** _____ **SATISFACTORY/UNSATISFACTORY** _____

COURSE DESCRIPTION, NO MORE THAN 3 LINES:
In this course students will reconstruct some modern mathematical discoveries in dynamical systems using widely accessible programs like spreadsheets and dynamical geometry software. Explorations will illustrate the relation of chaos theory to iteration of second order polynomials and fractal geometry as well as general mathematical patterns.

PREREQUISITES W/MINIMUM GRADE:*
PERMISSION OF THE INSTRUCTOR

COREQUISITES:
NONE

OTHER REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):

PREREQUISITES, COREQUISITES & REGISTRATION CONTROLS SHOWN ABOVE WILL BE ENFORCED FOR ALL COURSE SECTIONS.
****DEFAULT MINIMUM GRADE IS D-.***

MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:
PH. D IN MATHEMATICS

Other departments, colleges that might be affected by the new course must be consulted. List entities that have been consulted and attach written comments from each.
Computer Science

Richard Voss, rvoss@fau.edu, (561) 297-3358 _____
Faculty Contact, Email, Complete Phone Number

SIGNATURES

Approved by:	*Date:*
Department Chair: _____	_____
College Curriculum Chair: _____	_____
College Dean: _____	_____
UGPC Chair: _____	_____
Dean of the Graduate College: _____	_____

SUPPORTING MATERIALS

Syllabus—must include all details as shown in the UGPC Guidelines.

Written Consent—required from all departments affected.

Go to: *http://graduate.fau.edu/gpc/* to download this form and guidelines to fill out the form.

Email this form and syllabus to *diamond@fau.edu* and *eqirjo@fau.edu* one week ***before*** the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website by committee members prior to the meeting.

From: Bill Kalies <wkalies@fau.edu>
Subject: **New course proposal from Mathematics**
Date: March 3, 2010 5:56:22 PM EST
To: marty@cse.fau.edu, levow@fau.edu
Cc: Lee Klingler <klingler@fau.edu>
1 Attachment, 101 KB

Dr. Marty Solomon and Dr. Roy Levow

The mathematical sciences department is proposing a new course entitled "Dynamical Systems, Chaos, and Computing". This course is for our Master of Science in Teaching degree for high school teachers. A syllabus is attached. Since the title has the word "computing" in it, I wanted to make sure the computer science department would have no objection.

Please let me know whether or not your department would have any objections to this course.

Thanks,
Bill

Dr. Bill Kalies, Professor — Email: wkalies@fau.edu
Department of Mathematical Sciences — Phone: (561) 297-1107
Florida Atlantic University — FAX: (561) 297-2436
Boca Raton, FL 33431 — http://math.fau.edu/kalies

MTG 6418 D....pdf (101 KB)

Course Syllabus for Dynamical Systems, Chaos and Computing

1. **Course title/number, number of credit hours**
   Dynamical Systems, Chaos and Computing, MTG 6418, 3 credit hours

2. **Course prerequisites**
   a. Permission of the instructor

3. **Course logistics**
   a. Term – Fall 2010
   b. Notation if online course – N/A
   c. Class location and time (if classroom-based course) – To be determined

4. **Instructor contact information**
   a. Instructor's name – Richard Voss
   b. Office address – Science & Engineering Bldg, SE43, Room 210
   c. Office hours – To be determined
   d. Contact telephone number – office (561) 297-3358, fax (561) 297-2436
   e. E-mail address – rvoss@fau.edu

5. **TA contact information (if applicable)**
   N/A

6. **Course description**
   In this course students will reconstruct some modern mathematical discoveries in dynamical systems using widely accessible programs like spreadsheets and dynamical geometry software. Explorations will illustrate the relation of chaos theory to iteration of second order polynomials and fractal geometry as well as general mathematical patterns.

7. **Course objectives/student learning outcomes**
   Computers have revolutionized the practice of modern mathematics and its applications. They allow for the analysis and visualization of large datasets as well as provide new numerical and visualization tools for mathematical exploration, experimentation and intuition building. In this course, students will learn how modern mathematics and computing are integrated through examples involving iteration of functions, nonlinear phenomena and emerging patterns from cellular automata. Such concepts effectively integrate traditional mathematics with modern development such as Chaos Theory, Fractal Geometry, scientific computation and visualization.

   - Gain familiarity and understanding of the use of computers and visualization as in integral part of modern dynamical systems mathematics.
   - Gain familiarity with the concepts and standard models of Chaos Theory based on computation.
   - Develop skills for the analysis and communication of mathematical ideas.

8. **Course evaluation method**
   There will be graded work in the classroom accounting for 30% of the student's cumulative performance, in class presentation, accounting for 30% of the student's cumulative performance, and a journal that accounts for 40% of the cumulative performance. The overall grade in the course is derived from the cumulative performance according to the following table.

9. Course grading scale (optional)

Cumulative Performance	Grade
90% - 100%	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
0% - 59%	F

10. Policy on makeup tests, late work, and incompletes

If a student cannot attend an exam or hand in a homework project on time due to circumstances beyond their control then the instructor may assign appropriate make-up work. Students will not be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's final course grade. Reasonable accommodation will also be made for students participating in a religious observance. Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

11. Special course requirements (if applicable)

N/A

12. Classroom etiquette policy (if applicable)

University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

13. Disability policy statement

In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

14. Honor Code policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at http://www.fau.edu/regulations/chapter4/4.001 Honor_Code.pdf..

15. Required texts/readings

H-O Peitgen, H. Jurgens and D. Saupe, *Chaos and Fractals: New Frontiers of Science, Springer* 1993. ISBN-13: 978-0387979038.

16. Supplementary/recommended readings

a. D. Peak and M. Frame, *Chaos Under Control: The Art of Science of Complexity,* W.H. Freeman & Company 1994. ISBN-13 978-0716724292
b. H-O Peitgen, H. Jurgens, D. Saupe, C. Hosselbarth, E. Maletsky, T. Preciante and L. Yunker, *Fractals for the Classroom: Part I: Introduction to Fractals and Chaos*, Springer 1991. ISBN-13: 978-0387970417
c. M. Frame and B.B. Mandelbrot, *Fractals, graphics and mathematics education*, The Mathematical Association of America, 2002. ISBN-13: 978-0883851692.
d. R. Courant and H. Robbins, *What is mathematics?* Oxford University Press, 1996. ISBN-13: 978-0195105193.

17. Course topical outline

- Introduction and history of mathematics and computation (2 weeks)
- Iteration of functions (1 week)
- Graphical iteration, discrete maps and histograms (2 weeks)
- Attractors and repellars (1 week)
- Deterministic Chaos; sensitivity, mixing and periodic points (2 weeks)
- Period doubling and bifurcation diagrams (2 weeks)
- Continuous dynamical systems; Lorentz attractor (1 week)
- Iteration in the complex plane: Julia sets and the Mandelbrot set (2 weeks)
- Relation to Fractal Geometry (1 week)
- Cellular automata and their properties (2 weeks)