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## Graduate Programs—NEW COURSE PROPOSAL

<b>DEPARTMENT NAME:</b> MATHEMATICAL SCIENCES	<b>COLLEGE OF:</b> CHARLES E. SCHMIDT COLLEGE OF SCIENCE
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<b>RECOMMENDED COURSE IDENTIFICATION:</b> PREFIX _____ MTG _____ COURSE NUMBER 6415 _____ LAB CODE (L or C) _____ (TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU) <b>COMPLETE COURSE TITLE</b> FRACTAL GEOMETRY	<b>EFFECTIVE DATE</b> (first term course will be offered) _____
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<b>CREDITS:</b> 3	<b>TEXTBOOK INFORMATION:</b> H-O PEITGEN, H. JURGENS AND D. SAUPE, CHAOS AND FRACTALS: NEW FRONTIERS OF SCIENCE, SPRINGER 1993. ISBN-13: 978-0387979038.
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**GRADING (SELECT ONLY ONE GRADING OPTION):** REGULAR  PASS/FAIL \_\_\_\_\_ SATISFACTORY/UNSATISFACTORY \_\_\_\_\_

**COURSE DESCRIPTION, NO MORE THAN 3 LINES:**  
 Fractal Geometry is a new geometry that describes the seemingly irregular shapes and patterns we encounter in the natural world. This course explores the mathematical concepts behind Fractal Geometry and gives numerous applications of integration of mathematics with the natural world.

<b>PREREQUISITES W/MINIMUM GRADE:*</b> PERMISSION OF THE INSTRUCTOR	<b>COREQUISITES:</b> NONE	<b>OTHER REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):</b>
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*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.

Richard Voss, [rvoss@fau.edu](mailto:rvoss@fau.edu), (561) 297-3358 \_\_\_\_\_  
 Faculty Contact, Email, Complete Phone Number

<b>SIGNATURES</b>	<b>SUPPORTING MATERIALS</b>
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<b>Approved by:</b> Department Chair: _____ College Curriculum Chair: _____ College Dean: _____ UGPC Chair: _____ Dean of the Graduate College: _____	<b>Date:</b> _____ _____ _____ _____	<b>Syllabus</b> —must include all details as shown in the UGPC Guidelines. <b>Written Consent</b> —required from all departments affected. Go to: <a href="http://graduate.fau.edu/gpc/">http://graduate.fau.edu/gpc/</a> to download this form and guidelines to fill out the form.
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# Course Syllabus for Fractal Geometry

## 1. Course title/number, number of credit hours

Fractal Geometry, MTG 6415, 3 credit hours

## 2. Course prerequisites

- a. Permission of the instructor

## 3. Course logistics

- a. Term – Spring 2011
- 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 Bld, 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

Fractal Geometry is a new geometry that describes the seemingly irregular shapes and patterns we encounter in the natural world. This course explores the mathematical concepts behind Fractal Geometry and gives numerous applications of integration of mathematics with the natural world.

## 7. Course objectives/student learning outcomes

This course provides a mathematical introduction to Fractal Geometry as a new geometry that describes the seemingly irregular shapes and patterns we encounter in the natural world. Students will learn the basics of Fractal Geometry, such as self-similarity, through the detailed exploration of multiple constructions from a problem-solving and critical thinking perspective. Application of different areas of mathematics like geometry, algebra, calculus and probability will be examined in the light of new and unfamiliar fractal constructions. Technology will be used to present numerous numerical and graphical examples.

- Gain familiarity and understanding of basic self-similar fractal constructions and their mathematical descriptions in terms of a generalized fractal dimension.
  - Develop proof-writing skills and communication of mathematical ideas.
  - Apply different areas of mathematics and explore the geometry of nature
- Method of instruction:  
Lecture/workshops in the computer lab.

## 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](http://www.fau.edu/regulations/chapter4/4.001_Honor_Code.pdf). If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy.

#### **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. 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
- b. M. Frame and B.B. Mandelbrot, *Fractals, graphics and mathematics education*, The Mathematical Association of America, 2002. ISBN-13: 978-0883851692.
- c. H-O Peitgen, H. Jurgens, D. Saupe, E. Maletsky, T. Preciante, *Fractals for the Classroom: Strategic Activities Volume 3*, Springer 1999. ISBN-13: 978-0387984209.

## 17. Course topical outline

- Introduction to Fractal Geometry (1 week)
- Scaling, similarity and self-similarity (2 weeks)
- Iteration as a generator of fractals (2 weeks)
- Fractal dimension: theory and measurement (2 weeks)
- Length, area, volume and fractal dimension (2 weeks)
- Encoding fractals by geometrical transformations (2 weeks)
- Fractals and Probability (2 weeks)
- Application of fractals to characterizing and modeling nature (3 weeks)