

# FLORIDA ATLANTIC UNIVERSITY™

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## Graduate Programs—NEW COURSE PROPOSAL

DEPARTMENT: COMPLEX SYSTEMS & BRAIN SCIENCES

COLLEGE: CESCOS

**RECOMMENDED COURSE IDENTIFICATION:**

PREFIX ISC \_\_\_\_\_ COURSE NUMBER 5453 \_\_\_\_\_ LAB CODE (L or C)  
 None

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

COMPLETE COURSE TITLE: **NONLINEAR DYNAMICS IN COMPLEX SYSTEMS**

**EFFECTIVE DATE**

(first term course will be offered)

FALL 2013

CREDITS: 3

TEXTBOOK INFORMATION: STEPHEN STROGATZ, **NONLINEAR DYNAMICS AND CHAOS**, PERSEUS BOOKS PUBLISHING, CAMBRIDGE, MA (2000).

WILL BE REPLACED BY: ARMIN FUCHS, **NONLINEAR DYNAMICS IN COMPLEX SYSTEMS: THEORY AND APPLICATIONS**, AS SOON AS THIS BOOK APPEARS (EXPECTED END OF 2012)

GRADING (SELECT ONLY ONE GRADING OPTION): REGULAR X \_\_\_\_\_ SATISFACTORY/UNSATISFACTORY \_\_\_\_\_

**COURSE DESCRIPTION, NO MORE THAN 3 LINES:**

INTRODUCTION TO NONLINEAR DYNAMICAL SYSTEMS IN AN INTERDISCIPLINARY SETTING. THE TOPICS COVERED IN THIS COURSE INCLUDE ONE-, TWO- AND THREE-DIMENSIONAL ORDINARY DIFFERENTIAL EQUATIONS, BIFURCATIONS, ONE- AND TWO-DIMENSIONAL MAPS, ITERATED FUNCTION SYSTEMS, TIME SCALE SEPARATION AND SELF-ORGANIZATION, AND ELEMENTARY STOCHASTIC SYSTEMS.

PREREQUISITES \*: NONE

COREQUISITES \*: NONE

REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL)\*: NONE

\* PREREQUISITES, COREQUISITES AND REGISTRATION CONTROLS WILL BE ENFORCED FOR ALL COURSE SECTIONS.

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

Faculty contact, email and complete phone number:

Armin Fuchs  
 afuchs@fau.edu  
 561-297-0125

Departments and/or colleges that might be affected by the new course must be consulted and listed here. Please attach comments from each.  
 Mathematical Sciences

**Approved by:**

Department Chair: \_\_\_\_\_

College Curriculum Chair: \_\_\_\_\_

College Dean: \_\_\_\_\_

UGPC Chair: \_\_\_\_\_

Graduate College Dean: \_\_\_\_\_

**Date:**

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**ATTACHMENT CHECKLIST**

♦ **Syllabus** (see guidelines for requirements: <http://www.fau.edu/graduate/facultyandstaff/programscommittee/index.php>)

♦ **Written consent** from all departments affected by new course

Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) **one week before** the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting

# Nonlinear Dynamics in Complex Systems

ISC 5453

Fall 2013

Course: ISC 5453

Credits: 3

Prerequisites: None

Location: Behavioral Sciences #303

Time: Monday, Wednesday 11:00am-12:20pm

Instructor: Dr. Armin Fuchs

Office: Behavioral Sciences #307

Email/Phone: [fuchs@ccs.fau.edu](mailto:fuchs@ccs.fau.edu) 561-297-0125

Office hours: Monday, Wednesday 12:30-1:30pm and by appointment

Description: Introduction to nonlinear dynamical systems in an interdisciplinary setting. The topics covered in this course include one- two and three-dimensional ordinary differential equations, bifurcations, one- and two-dimensional maps, iterated function systems, time scale separation and self-organization, and elementary stochastic systems.

Objectives: Successful completion of this course will enable students to follow the literature on Complex Systems and apply methods of nonlinear dynamics to their own research.

Topics: Ordinary differential equations and phase flow  
Linear versus nonlinear  
Dynamical systems in one, two and higher dimensions  
Stability, potentials and Lyapunov functions  
Stationary, periodicity, and non-periodic solutions  
Discrete maps  
Iterations in space  
Time-scale separation, self-organization and synergetics  
Stochastic systems

Literature: Armin Fuchs (2012). Nonlinear Dynamics in Complex Systems: Methods and Applications to the Life-, Neuro- and Natural Sciences. Springer, Heidelberg

Grading: Midterm exam: 45% (take home exam, about 10 days)  
Final exam: 45% (take home exam about 10 days)  
Attendance and contributions during class: 10%

Makeup: Late work is not accepted except in extraordinary circumstances.

#### Disability policy statement

*In compliance with the Americans with Disabilities Act (ADA), students who require reasonable accommodations 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, LA 240 (954-236-1222); in Jupiter, SR 110 (561-799-8010); or at the Treasure Coast, CO 117 (772-873-3441) - and follow all OSD procedures.*

#### Code of Academic Integrity 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.*

Required:

Armin Fuchs (2012). *Nonlinear Dynamics in Complex Systems: Methods and Applications to the Life-, Neuro- and Natural Sciences*. Springer, Heidelberg

Bibliography:

Stephen H. Strogatz (1994/2010). *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering*. Perseus Book Publishing, Cambridge, MA (older than ten years but an excellent book)

Eugene M. Izhikevich (2006). *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. MIT Press, Cambridge, MA

Stephen Wiggins (2004). *Introduction to Applied Nonlinear Dynamical Systems and Chaos*. Springer, Heidelberg

Peter Erdi (2007). *Complexity Explained*. Springer, Heidelberg

Armin Fuchs (2010). Dynamical systems in one and two dimensions: a geometrical approach. In: R. Huys, V.K. Jirsa, eds., *Nonlinear dynamics in human behavior*, Springer, Heidelberg

**Subject:**new course proposal

**Date:**Fri, 6 Apr 2012 14:55:11 +0000

**From:**Lee Klingler <[klingler@fau.edu](mailto:klingler@fau.edu)>

**To:**Armin Fuchs <[fuchs@ccs.fau.edu](mailto:fuchs@ccs.fau.edu)>

**CC:**Charles Roberts <[croberts@fau.edu](mailto:croberts@fau.edu)>

Dear Armin,

The mathematics department supports your proposed new graduate course "Introduction to Dynamical Systems and Chaos". The proposed new course does not have substantial overlap with any course in the Department of Mathematical Sciences.

Best regards,  
Lee