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## Graduate Programs—NEW COURSE PROPOSAL

DEPARTMENT NAME: **MATHEMATICAL SCIENCES** COLLEGE OF: **CHARLES E. SCHMIDT COLLEGE OF SCIENCE**

RECOMMENDED COURSE IDENTIFICATION:  
 PREFIX \_\_\_\_\_ MAP \_\_\_\_\_ COURSE NUMBER **6336** LAB CODE (L or C) \_\_\_\_\_  
 (TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU)  
 COMPLETE COURSE TITLE  
**ORDINARY DIFFERENTIAL EQUATIONS**

**EFFECTIVE DATE**  
 (first term course will be offered)

CREDITS:  
**3**

TEXTBOOK INFORMATION:  
**ORDINARY DIFFERENTIAL EQUATIONS WITH APPLICATIONS BY C. CHICONE, 1999, SPRINGER-VERLAG..**

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

COURSE DESCRIPTION, NO MORE THAN 3 LINES:  
**INTRODUCTION TO THE THEORY OF ORDINARY DIFFERENTIAL EQUATIONS (ODE's). EXISTENCE, UNIQUENESS, CONTINUOUS DEPENDENCE OF SOLUTIONS, THE HARTMAN-GROBMAN THEOREM, THE STABLE MANIFOLD THEOREM, THE POINCARÉ-BENDIXSON THEOREM, FLOQUET THEORY. APPLICATIONS TO MECHANICAL AND BIOLOGICAL SYSTEMS.**

PREREQUISITES W/MINIMUM GRADE: \*  
**MAA 5228 INTRODUCTORY ANALYSIS I AND MAS 5145 LINEAR ALGEBRA (MINIMUM GRADE C) OR PERMISSION BY 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.

Vincent Naudot , [vnaudot@fau.edu](mailto:vnaudot@fau.edu), (561) 297-1339 \_\_\_\_\_  
 Faculty Contact, Email, Complete Phone Number

### SIGNATURES

**Approved by:**  
 Department Chair: \_\_\_\_\_  
 College Curriculum Chair: \_\_\_\_\_  
 College Dean: \_\_\_\_\_  
 UGPC Chair: \_\_\_\_\_  
 Dean of the Graduate College: \_\_\_\_\_

**Date:**  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### 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.

## Course Syllabus for Ordinary Differential Equations

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

Ordinary Differential Equations, MAP 6336, 3 credit hours

### 2. Course prerequisites

- a. MAA 5228 Introductory Analysis I and MAS 5145 Linear Algebra (Minimum Grade C)  
or
- b. 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 – Vincent Naudot
- b. Office address – Science & Engineering Bldg, SE43, Room 278
- c. Office hours – To be determined
- d. Contact telephone number – office (561) 297-1339, fax (561) 297-2436
- e. E-mail address – vnaudot@fau.edu

### 5. TA contact information (if applicable)

N/A

### 6. Course description

Introduction to the theory of Ordinary Differential Equations (ODE's).

Existence, uniqueness, continuous dependence of solutions, the Hartman-Grobman Theorem, the Stable Manifold Theorem, the Poincare-Bendixson Theorem, Floquet Theory. Applications to mechanical and biological systems.

### 7. Course objectives/student learning outcomes

This course aims to introduce fundamental theory of Ordinary Differential Equations (ODE). Students will be able to:

- Solve linear systems of ODE's in n-dimensions
- Analyze the linearization of nonlinear systems near an equilibrium point via the Hartman-Grobman Theorem
- Apply the Stable Manifold Theorem
- Perform phase portrait analysis in 1 and 2 dimensions
- Recognize Hamiltonian and gradient vector fields and their properties
- Determine Lyapunov and Poincare Stability
- Analyze periodic orbits, the Poincare-Bendixson Theorem and Floquet theory

- Apply the Fundamental Theorem on existence and uniqueness of solutions and continuous dependence on initial conditions
- Understand applications to mechanical and biological systems

### 8. Course evaluation method

There will be graded homework assignments accounting for 40% of the student's cumulative performance, a midterm exam, accounting for 30% of the student's cumulative performance, and a final exam that accounts for 30% 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 |
|------------------------|-------|
| >94%                   | A     |
| >90% - 94%             | A-    |
| >87% - 90%             | B+    |
| >83% - 87%             | B     |
| >80% - 83%             | B-    |
| >75% - 80%             | C+    |
| >65% - 75%             | C     |
| >60% - 65%             | C-    |
| >57% - 60%             | D+    |
| >53% - 57%             | D     |
| >50% - 53%             | D-    |
| <50%                   | 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).

#### **15. Required texts/readings**

*Ordinary Differential Equations with Applications* by C. Chicone, 1999, Springer-Verlag.

#### **16. Supplementary/recommended readings**

- a. *Differential Equations, Dynamical Systems, and Linear Algebra*, by M.W. Hirsch and S. Smale, 1974, Academic Press.
- b. *Nonlinear Ordinary Differential Equations: An Introduction to Dynamical Systems, 3rd ed.*, by D.W. Jordan and P. Smith, 1987, Oxford.
- c. *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*, by J. Guckenheimer and P. Holmes, 1983, Springer.
- d. *Nonlinear Dynamics and Chaos*, by S. Strogatz, 1994, Perseus Books.

#### **17. Course topical outline**

- Existence and uniqueness of solutions (ca. 1 week)
- Continuous dependence of solutions (ca. 1 week)
- Invariant Manifold Theorem (ca. 1 week)
- Geometrical interpretation (ca. 1 week)
- Stability and Linearization (ca. 1 week)
- Hartman-Grobman Theorem (ca. 1 week)
- Poincare map & Periodic solution (ca. 2 weeks)
- Limit sets (ca. 2 weeks)
- Contracting Mapping Theorem (ca. 1 week)
- Implicit Function Theorem (ca. 1 week)

- Linear System & Homogeneous Equations (ca. 1 week)
- Gronwall's inequality (ca. 1 week)
- Floquet Theory & Lypunov exponent (ca. 2 weeks)