

Date and Time: M,W,F: 12:10-13:00

Classroom: Terrell 106

Course Webpage: Blackboard

Instructor: Nikolaos Voulgarakis

Office: Neill 325

Office Hours: M,W,F: 13:10-14:00 or by appointment

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Textbook: Mathematics Applied to Deterministic Problems in the Natural Sciences by C.C. Lin and L. A. Segel, Macmillan, New York, 1974 (ISBN: 9780898712292).

Course Outline: Math 486/586 is an introductory course in mathematical models with an aim of addressing problems arisen from the natural sciences. The class will deal with construction, analysis and interpretation of mathematical models that shed light on significant problems in the natural sciences. We will cover the following topics.

PART I: Ordinary Differential Equations

- 1) **Introduction to dynamical systems** (Definitions, critical points, linearized stability, Flows and invariant manifolds, Poincare's method for periodic orbits)
- 2) **Simplification, Dimensional Analysis, and Scaling**
- 3) **Regular Perturbation Theory** (applied to simple mechanical systems)
- 4) **Applications:** simple pendulum, chemical reactions, projectile problems, predator prey model, SIR model

PART II: Partial differential equations

- 5) **Heat and Wave equation**
- 6) **Field equations of continuum mechanics**
- 7) **Potential Theory** (Laplace and Poisson equations)
- 8) **Applications:** Diffusion and reaction-diffusion processes

PART II: A very brief introduction to stochastic processes

- 1) **The master equation and the Langevin equation**
- 2) **Applications:** same as PART I

Grading:

- Homework: 20%
- Exam1: 25%
- Exam2: 25%
- Final Exam (take home): 30%

Academic Integrity is the cornerstone of the university. All assignments are to be done by *you*, not someone else. You are encouraged to work together and to discuss homework assignments by asking questions such as, "How do you do this type of problem again?" or "What is the idea here?" But you should not sit down with someone else's paper in front of you and refer to it to get your work done. Any student who violates the University's standard of conduct related to academic integrity will be referred to the Office of Student Conduct and may fail the assignment and/or the course. You can learn more about academic integrity at <http://www.academicintegrity.wsu.edu/>

WSU Reasonable Accommodations: Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, please visit the Access Center. All accommodations **MUST** be approved through the Access Center (Washington Bldg, Room 217). Please stop by or call 509-335-3417 to make an appointment with an Access Advisor.

WSU Safety Measures: Washington State University is committed to maintaining a safe environment for its faculty, staff and students. Please visit <http://safetyplan.wsu.edu> and <http://oem.wsu.edu/emergencies> to access the Campus Safety Plan and emergency information. You should also become familiar with the WSU Alert Site (<http://alert.wsu.edu>) where information about emergencies and other issue affecting WSU will be found.