Department of Mathematics
Pomona College

Course Outline for Mathematics 181/281
Dynamical Systems
Spring 2019

Time	MWF 9:00 AM - 9:50 AM
Place:	Millikan Room 2393
Instructor:	Dr. Adolfo J. Rumbos
Office:	Andrew 2287.
Phone/e-mail:	ext. 18713 / arumbos@pomona.edu
Courses Website:	**http://pages.pomona.edu/~ajr04747/**
Office Hours:	TR 9:00 am - 10:00 am, or by appointment
Texts:	(Recommended) *Ordinary Differential Equations* by Jack K. Hale Dover Publications, Inc., 2009 edition. (Recommended) *Nonlinear Dynamics and Chaos* by Steven H. Strogatz CRC Press LLC, 2nd edition.
Prerequisites:	Linear algebra, elementary ordinary differential equations and some real analysis course

Course Description. This course provides an introduction to the theory and applications of continuous Dynamical Systems. We begin with the study of the fundamental existence and uniqueness theorems for ordinary differential equations, as well as the results on continuous dependence on initial conditions and parameters. We then define continuous dynamical systems and explore their properties. In particular, we study stability and long-term properties of dynamical systems, and discuss various techniques and results that arise in the theory and applications.

Course Structure and Expectations. The structure of the coursed is centered on lectures and readings on the topics listed in the attached tentative schedule of lecture and examinations, homework assignments, two examinations and a term project. Readings and problem sets will be assigned and collected on a weekly basis. Students are strongly encouraged to work on every assigned problem. **Late homework assignments will not be graded**. The term project will consist of a **paper and presentation** on a topic not covered in the lectures. Ideas for topics in the term project may be found in the recommended texts for the courses; possible topics may range from applications of the theory and techniques learned in class to problems in various fields in science to advanced analysis techniques that are not covered in the course. Presentations will take place in the last weeks of the semester

Grading Policy. Grades will be based on the homework, two examinations and a term project involving an advanced topic in the theory and applications of dynamical systems. The overall score will be computed as follows:

homework	20%
Examinations	50%
term project	30%

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Tentative Schedule of Lectures and Examinations

Date		Topic
W	Jan. 23	What is a dynamical system
F	Jan. 25	Fundamental existence and uniqueness theory
M	Jan. 28	Existence and uniqueness theory continued
W	Jan. 30	Existence and uniqueness theory continued
F	Feb. 1	Continuous dependence on initial conditions
M	Feb. 4	Continuous dependence on initial conditions (continued)
W	Feb. 6	Continuous dependence on parameters
F	Feb. 8	Continuous dependence on parameters (continued)
M	Feb. 11	Global existence results
W	Feb. 13	Global existence (continued)
F	Feb. 15	Global existence (continued)
M	Feb. 18	Definition of dynamical systems
W	Feb. 20	Integral curves, flow domains and flows
F	Feb. 22	Integral curves, flow domains and flows (continued)
M	Feb. 25	Orbits
W	Feb. 27	Invariant sets
F	Mar. 1	Singular points
M	Mar. 4	Review
W	Mar. 6	**Exam 1**
F	Mar. 8	Fixed points
M	Mar. 11	Invariant sets
W	Mar. 13	Cycles and periodic solutions
F	Mar. 15	Cycles and periodic solutions (continued)
M	Mar. 18	*Spring Recess!*
W	Mar. 20	*Spring Recess!*
F	Mar. 22	*Spring Recess!*

Date		Topic
M	Mar. 25	Equilibrium points
W	Mar. 27	Liapunov stability
F	Mar. 29	*Cesar Chavez Day*
M	Apr. 1	Liapunov stability (continued)
W	Apr. 3	Liapunov functions
F	Apr. 5	Liapunov Theorem
M	Apr. 8	Limit cycles
W	Apr. 10	Stability of limit cycles
F	Apr. 12	Planar systems
M	Apr. 15	Planar systems (continued)
W	Apr. 17	The Poincaré-Bendixson Theorem
F	Apr. 19	The Poincaré-Bendixson Theorem (continued)
M	Apr. 22	Review
W	Apr. 24	**Exam 2**
F	Apr. 26	Special Topic
M	Apr. 29	Special Topic
W	May 1	Special Topic
F	May 3	Special Topic
M	May 6	Special Topic
W	May 8	Special Topic