

MATH 411 : Ordinary Differential Equations

(Instructor: Alberto Bressan, Fall 2009)

Meeting time: Tuesday-Thursday 1:00 - 2:15, Sackett 117.

Textbook: W. Kelley and A. Peterson *The theory of Differential Equations, Classical and Qualitative*, Pearson Education, Upper Saddle River NJ, 2004.

The course will cover three main topics:

- Linear systems of differential equations
- Nonlinear autonomous systems in the plane
- Sturm-Liouville problems arising in the Calculus of Variations

Sections covered each week

Aug. 25-27: 1.1, 1.2. Basic definitions. Existence - uniqueness of solutions. Review of explicit solution methods. First order linear equations.

Sept. 1-3: 1.3, 1.4. Phase line diagrams, bifurcation.

Sept. 8-10: 2.1, 2.2. Introduction to linear systems. The vector equation $x' = A(t)x$.

Sept. 15-16: 2.3. The matrix exponential function.

Sept. 22-24: 2.4, 2.5. The matrix norm. Floquet theory.

Sept. 29 - Oct. 1: 2.5. Floquet theory. Review.

Oct. 6-8: 3.1, 3.2. Autonomous nonlinear systems. Phase plane diagrams.

Oct. 13-15: 3.3. Phase plane diagrams for linear systems.

Oct. 20-22: 3.4, 3.5. Stability of nonlinear systems. Liapunov method. Linearization method.

Oct. 27-29: 3.6. Periodic solutions of nonlinear planar systems.

Nov. 3-5: 3.6, 3.7. Nonlinear planar systems, Three-dimensional systems.

Nov. 10-12: 5.8. Calculus of Variations: The Euler-Lagrange equations.

Nov. 17-20: 5.1, 5.2. The self-adjoint second order differential equation. Examples.

Dec. 1-3: 5.3, 5.4. The “variation of constants” formula. Sturm-Liouville problems.

Dec. 8-10: 5.5. Sturm-Liouville problems. Disconjugacy. Review.

GRADING will be based on Homework 35%, Midterm exam 30%, Final exam 35%.

OFFICE HOURS: McAllister 201, Mondays 1:45 - 2:45 and Thursdays 11:00 - 12:00.

HOMEWORK will be collected each week on Tuesdays, after class.

Homework assignments:

Due date:

Sept. 1: 1.2, 1.3, 1.5.

Sept. 8: 1.7, 1.9, 1.16, 1.17, 1.25.

Sept. 15: 2.1, 2.2, 2.5, 2.9.

Sept. 22: 2.14, 2.15, 2.16, 2.18, 2.19 (i)-(ii), 2.20 (i)-(ii).

Sept. 29: 2.24, 2.36 (i)-(ii)-(iii), 2.37.

Oct. 6: 2.51 (i)-(ii)-(iii), 2.52, 2.54 (i)-(ii), 2.57.

Oct. 13: 3.1, 3.2, 3.3, 3.4, 3.5.

Oct. 18: 3.7 (i)-(iii)-(iv), 3.10 (i)-(ii), 3.11 (i)-(ii)-(iv), 3.12, 3.13.

Oct. 27: 3.16 (i)-(ii), 3.19, 3.21, 3.23, 3.24 (i)-(ii), 3.26.

Nov. 3: 3.34, 3.35, 3.37, 3.40.

Nov. 10: 3.43 (i)-(ii), 3.44 (i)-(ii), 3.49.

Nov. 17: 5.46, 5.48, 5.50.

Dec. 1: 5.1 (i)-(ii)-(iii)-(iv), 5.8, 5.10 (i)-(ii)-(iv), 5.11 (i)-(ii)-(iv).

Dec. 8: 5.14 (i)-(ii), 5.15 (i)-(ii)-(iv)-(v), 5.19, 5.22 (ii)-(iii).

Academic Integrity Policy: All Penn State Policies regarding ethics and honorable behavior apply to this course.

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

From Policies and Rules, Student Guide to the University Policy 49-20: Academic dishonesty includes, but is not limited to, cheating, plagiarizing, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with academic work of other students. A student charged with academic dishonesty will be given oral or written notice of the charge by the instructor. If students believe that they have been falsely accused, they should seek redress through informal discussions with the instructor, the department head, dean or campus executive officer. If the instructor believes that the infraction is sufficiently serious to warrant the referral of the case to Judicial Affairs, or if the instructor will award a final grade of F in the course because of the infraction, the student and instructor will be afforded formal due process procedures.

Based on the University's Faculty Senate Policy 49-20, a range of academic sanctions may be taken against a student who engages in academic dishonesty. Please see the Eberly College of Science Academic Integrity homepage for additional information and procedures.

Special Fall 2009 Flu Protocols: In compliance with Pennsylvania Department of Health and Centers for Disease Control recommendations, students should NOT attend class or any public gatherings while ill with influenza. Students with flu symptoms will be asked to leave campus if possible and to return home during recovery. The illness and self-isolation period will usually be about a week. It is very important that individuals avoid spreading the flu to others.

Most students should be able to complete a successful semester despite a flu-induced absence. Faculty will provide students who are absent because of illness with a reasonable opportunity to make up missed work. Ordinarily, it is inappropriate to substitute for the missed assignment the weighting of a semester's work that does not include the missed assignment or exam. Completion of all assignments and exams assures the greatest chance for students to develop heightened understanding and content mastery that is unavailable through the weighting process. The opportunity to complete all assignments and exams supports the university's desire to enable students to make responsible situational decisions, including the decision to avoid spreading a contagious virus to other students, staff, and faculty, without endangering their academic work.

Students with the flu do not need to provide a physician's certification of illness. However, ill students should inform their teachers (by e-mail) as soon as possible that they are absent because of the flu. Likewise, students should contact their instructors as quickly as possible to arrange to make up missed assignments or exams.

If you have questions about academic policy-related issues, please call the Associate Dean/Chief Academic Officer of your college. For health-related questions you can email Dr. Margaret Spear, director, University Health Services, at uhsinfo@sa.psu.edu.