MATH 417 : Qualitative Theory of Ordinary Differential Equations

Instructor: Alberto Bressan - Spring 2022

Meeting time: Tuesday-Thursday 10:35–11:50, Osmond 110.

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The course will cover the following main topics:

• One dimensional flow
• Stability, bifurcations
• Linear systems of differential equations
• Nonlinear autonomous systems in the plane
• Limit cycles
• Bifurcations of planar systems
• Introduction to chaotic dynamics

GRADING will be based on Homework 40%, Midterm exams (15% each), Final exam 30%.

OFFICE HOURS: Wednesday 4:30–5:30 pm, via zoom: https://psu.zoom.us/j/4459978263
Other times can be scheduled by appointment.

HOMEWORK will be due each week on Thursdays. It will have to be scanned and uploaded on CANVAS.
Calendar

Jan 10: classes begin
Feb. 24: Midterm Exam 1 (in class)
March 7–13: Spring Break, no classes
April 7: Midterm Exam 2 (in class)
April 29: classes end
May 2–6: Final Exam (yet to be scheduled)

Sections covered each week (tentatively)


Feb. 1–3: 3.2–3.4. Different types of bifurcations for flows on the line. Normal forms.

Feb. 8–10: 5.0–5.2. Linear systems in the plane.

Feb. 15–17: 6.0–6.3. Introduction to phase plane analysis of nonlinear systems.

Feb. 22–24: Review, Midterm Exam 1 (covering Sections 2, 3, 5).


March 29–31: 8.0–8.2. Bifurcations in nonlinear planar systems.

April 5-7: Review, Midterm Exam 2 (covering Sections 6, 7).

April 12–14: 9.0–9.2. Introduction to chaotic dynamics. The Lorenz equations.


April 26–28. Review.
Homework assignments (from the textbook):

Due date:

Jan. 20:  2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.8, 2.2.9, 2.2.10,

Jan. 27:  2.4.4, 2.5.1, 2.7.1, 2.7.3, 2.7.4.

Feb. 3:  2.8.3, 3.1.1, 3.1.3, 3.2.1, 3.2.4.

Feb. 10:  3.4.1, 3.4.4, 3.4.8, 3.4.11, 3.4.16.

Feb. 17:  5.1.1, 5.1.2, 5.1.4, 5.1.5, 5.1.7, 5.2.1, 5.2.3, 5.2.10.

March 3:  6.1.1, 6.1.2, 6.1.6, 6.1.8, 6.1.9, 6.1.12, 6.1.13, 6.3.1, 6.3.2.

March 17:  6.4.1, 6.5.1, 6.5.4, 6.5.8, 6.5.11, 6.6.1, 6.6.2, 6.6.5, 6.6.7.

March 24:  7.1.1, 7.1.5, 7.1.8, 7.2.1, 7.2.2, 7.2.3, 7.2.7.

March 31:  7.3.1, 7.3.3, 7.3.5, 7.3.10, 7.4.1, 7.5.1.

April 14:  8.1.1, 8.1.2, 8.1.3, 8.1.6, 8.1.9, 8.2.1, 8.2.2.
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 by all members of the University community 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. 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.

Mask guidance

Penn State University requires everyone to wear a face mask in all university buildings, including classrooms, regardless of vaccination status. ALL STUDENTS MUST wear a mask appropriately (i.e., covering both your mouth and nose) while you are indoors on campus. This is to protect your health and safety as well as the health and safety of your classmates, instructor, and the university community. Anyone attending class without a mask will be asked to put one on, or leave. Instructors may end class if anyone present refuses to appropriately wear a mask for the duration of class. Students who refuse to wear masks appropriately may face disciplinary action for Code of Conduct violations. If you feel you cannot wear a mask during class, please speak with your adviser immediately about your options for altering your schedule.

Disability accomodation

Penn State welcomes students with disabilities into the University’s educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources (SDR) website provides contact information for every Penn State campus http://equity.psu.edu/sdr/disability-coordinator. For further information, please visit Student Disability Resources website http://equity.psu.edu/sdr/.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelines http://equity.psu.edu/sdr/guidelines. If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.
Counseling and psychological services

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients’ cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS)
http://studentaffairs.psu.edu/counseling/ 814-863-0395
Counseling and Psychological Services at Commonwealth Campuses
https://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/
Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational equity/Report bias

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias webpage http://equity.psu.edu/reportbias/