Differential Equations with Linear Algebra (MAT 308)

Stony Brook University, Spring 20202

This is a course about differential equations (equations that involve functions and their derivatives) and how to solve such equations. The equations show often as models for natural phenomena like motion of wave, distribution of heat, motion of pendulums and springs. We also would be interested in the qualitative behavior of solutions which for example would tell us what happen for the motion of waves and springs after long time.
It turns out that linear algebra and calculus are the main tools to solve differential equation and understand their behavior.
Thus we spend a portion of class to learn about basic concepts and tools of linear algebra. We will roughly cover chapters 10, 3, 11, 12, 13 and some selected topics from our textbook. Our emphasize would be on examples, solving problems and application, although understanding of the basic concepts would be crucial for solving problems.

Prerequisite: MAT 307 or MAT 205 and MAT 211.

Course information:

Lectures:

Stony Brook University, Spring 2020,
MW 4-5:20 pm,
Earth&Space 069.

Instructor: Babak Modami

Office: MATH Tower 3-114,
Office hours: M 1-2pm, W 11am-noon MLC: W 6-7pm,
Email: babak.modami@stonybrook.edu.

Teaching assistant: Jared Krandel

Recitation: Th 4-4:53 pm at Earth&Space 069,
Office: MATH Tower S-240A,
Office hours: Tu 4-5pm, MLC: W 5-7pm,
Email: jared.krandel@stonybrook.edu.

Textbook:

Multivariable Mathematics, 4th Edition, by Williamson and Trotter (Pearson/Prentice-Hall, Inc.)

Homework:

Problems will be assigned from the textbook each W and will be collected in the following W class. Only a selection of problems will be graded but we suggest that students solve and return as many of the problems (ideally all of them) for grading.
No late homework will be accepted except under very exceptional circumstances.

Exams and grading policy:

Midterm 1: Feb 26, time and location of class: 20%
Midterm 2: April 15, time and location of class: 20%
Final: May 12, 8:30-11pm location of class (cumulative with emphasize on the last part): 35%
Homework: three quarters of homework would be enough to get full credit: 25%

No make-up exams will be given. If a midterm exam is missed because of a serious (documented) illness or emergency, your semester grade will be determined on the basis of other work done in the course. Exams missed for other reasons will be counted as failures.

Blackboard:

The grades of homework assignments and exams will be posted on the blackboard.
Also new announcements and various documents like lecture notes and sample exams will be posted on the blackboard.

Resources:

If you have questions regarding the course material at any time during the semester, you are encouraged to visit your instructor or TA during office hours, or make a separate appointment if necessary. Your instructors will also reply to email, within reason. Another excellent source of help is the Mathematics Learning Center (S-235 in the Math Building - basement level), which is staffed by advanced math majors, graduate students and faculty daily. For a schedule of their hours, check their website .

Students with Disabilities:

If you have a physical, psychological, medical, or learning disability that may impact on your ability to carry out assigned course work, please Disability Support Services at (631) 632-6748 DSS. DSS office: Room 133 in the Humanities Building. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential. Arrangements should be made early in the semester so that your needs can be accommodated. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and DSS. For procedures and information go to the DSS website above.

Academic Integrity:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another persons work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website here .

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits the students' ability to learn. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Handbook and the Faculty-Employee Handbook.

Syllabus and weakly homework:

Week of	Topics	Problems due	Due date
Jan 27	First-order differential equations: 10.1: Direction fields 10.2: Separation of variables 10.3: linear equations, integrating factors	10.1A: 2, 3, 7, 9, 11, 12, 19, 20 10.2: 3, 9, 18, 19, 21 10.3: 3, 4, 6 ,7, 11, 19	Feb 5
Feb 3	Vector spaces and linearity: 3.1: Linear Maps/Euclidean spaces	the exercise was given in the	Feb 12

	3.2: Vector Spaces 3.3: Linear Maps/Vector spaces	class, 3.1: 4, 6, 8, 13, 16	
Feb 10	3.4 Image and Null Space 3.5 Coordinates and Dimension 3.6 Eigenvalues and Eigenvectors	3.2 : 6, 7, 11(a), 16, 20, 23 3.3: 13, 17(a) 3.4: 16, 18.	Feb 19
Feb 17	3.6 Eigenvalues and Eigenvectors 3.7 Inner Products	3.5AB : 4, 8, 15, 24 3.5C: 4 3.6A: 4, 6 3.7A:1, 4	Feb 26
Feb 24	Ch.3/Ch.10/Midterm Review 1 Midterm 1, Wed. Feb 26	no homework	NA
March 2	Second-order differential equations: 11.1 Differential Operators 11.2 Complex Solutions	3.7B: 2,3, 4 11.1: 8, 13, 11.2A: 16, 21, 22, 31	March 11
March 9	11.2 Higher Order Equations 11.3 Non-homogeneous Equations 11.4 Oscillations	11.2BC: 3,9 11.3AB: 1, 2, 5,10 11.3CD: 2, 9 11.4: 4,5, 9.	March 30
March 16	Spring break (have fun)		
March 23	11.5 Laplace Transform 11.6 Convolution		
March 30	12.1 Vector Fields 12.2 Linear Systems		
April 6	13.1 Eigenvalues/vectors 13.2 Matrix		

	exponentials		
April 13	-- Midterm Review 2 Midterm 2 April 15		
April 20	13.4 Equilibrium and Stability 13.4 Nonlinear Systems		
April 27	14.6 Differential Equations 14.7 Power Series Solutions		
May 4	Final Review		
May 11	Final exam on May 12		