MATH 311, Section 504

Topics in Applied Mathematics I

(Linear Algebra and Vector Analysis)

Spring 2022

Instructor: Yaroslav Vorobets
Time: TR 12:45 – 2:00 p.m.
Location: BLOC 163
Web page: `http://www.math.tamu.edu/~yvorobet/MATH311/`

Office: BLOC 301b (email: `yvorobets@tamu.edu`).

Office hours: TR 2:10 – 3:00 p.m. (in person), W 5:00 – 6:00 p.m. (via ZOOM), and by appointment.

Text: S. J. Leon and S. J. Colley, *Math 311: Linear Algebra and Vector Calculus*, Pearson (custom edition for Texas A&M University, eText only: `http://www.pearsoncustom.com/tx/math311/`).

Prerequisites: MATH 221, 251, or 253 (multivariable calculus); MATH 308 (differential equations) or concurrent enrollment; junior or senior classification (or approval of instructor).

Grading system: There will be 2 in-class tests and the final comprehensive exam. The tests are worth 100 points (or 22.2% of the final grade) each, the final exam is worth 150 points (or 33.3% of the final grade). Extra credit can be earned by solving bonus problems (on tests and the final exam). The homework will account for another 100 points (or 22.2% of the final grade). The final grades will be assigned according to the 90–80–70–60% scale, that is, A for 405+ pts, B for 360–404 pts, C for 315–359 pts, D for 270–314 pts, and F for less than 270 pts.

The *tentative* dates for the two tests are March 3 and April 7. The final exam is scheduled for Tuesday, May 10, 8:00 – 10:00 a.m.

The (weekly) homework assignments should be submitted through Gradescope (via Canvas). Late submissions may be penalized if circumstances warrant.

Make-ups: Make-ups for missed quizzes and tests will only be allowed for a university approved excuse in writing. Wherever possible, inform the instructor before a test is missed. Consistent with University Student Rules, students are required to notify the instructor by the end of the next working day after missing a test. Otherwise, they forfeit their rights to a make-up.

Academic integrity: Although students are encouraged to discuss homework problems, each student is expected to write his/her own solutions. Copying another student's work is dishonest and academically worthless. For information on the Honor Council Rules and Procedures, visit `http://aggiehonor.tamu.edu/`

Students with disabilities: If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845–1637 (or visit `http://disability.tamu.edu`). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Title IX and limits to confidentiality: Class materials are generally considered confidential pursuant to student record policies and laws. As a University employee, I, however, must report allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus if you share such information with me.

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Course content: The course consists of two parts. The first, larger part is an introductory course in linear algebra covering the abstract concepts of vector space and linear transformation as well as some models and applications of these concepts. The main topics to be covered are: systems of linear equations, matrices, determinants, vector spaces, linear transformations, orthogonality, eigenvalues and eigenvectors. In the second part of the course, the concepts of linear algebra are applied to the study of vector calculus. The topics to cover here include gradient, divergence, curl, line and surface integrals, Green's, Gauss' and Stokes' theorems.

The emphasis of the course is on applications and problem solving. However the course also contains a substantial amount of abstract theory. The student should be able to do simple proofs.

Course outline

Part I ($\approx$ 3 weeks): *Elementary linear algebra*

- Systems of linear equations
- Gaussian elimination, Gauss-Jordan reduction
- Matrices, matrix algebra
- Determinants

Leon/Colley: Chapters 1–2

Part II ($\approx$ 4 weeks): *Abstract linear algebra*

- Vector spaces
- Linear independence
- Basis and dimension
- Coordinates, change of basis
- Linear transformations

Leon/Colley: Chapters 3–4

Part III ($\approx$ 3 weeks): *Advanced linear algebra*

- Eigenvalues and eigenvectors
- Diagonalization
- Orthogonality
- Inner products and norms
- The Gram-Schmidt orthogonalization process

Leon/Colley: Chapters 5–7

Part IV ($\approx$ 4 weeks): *Vector analysis*

- Main notions of vector analysis
- Review of multiple integrals
- Line and surface integrals
- Green's, Gauss' and Stokes' theorems

Leon/Colley: Chapters 8–11