MA110D - Introduction to Linear Algebra

Course Syllabus – Fall 2024

- **General Information:**

  Instructor: Prof. S. M. Mintchev

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  Department / School: Mathematics / Engineering

  Credits and Contact Hours: 2 credits; 2 contact hours.

  Class Meeting Time: TUE 2pm-4pm, Rm. 505.

  Office Hours: TUE 4pm-7pm; THU 3pm-5pm.

- **Overarching Policies on Academic Standards and Regulations (to be reviewed in conjunction with the specific course policies delineated below):** Please visit *this linked page* and review the information provided, as it pairs with the course-specific information provided herein.

- **Academic Integrity Statement (for Prof. Mintchev's classes):**

  By maintaining your registration for this class past the Add/Drop period for the semester, you acknowledge your receipt of this syllabus and your review of the stipulations set forth herein. Most importantly, you acknowledge your responsibility to abide by academic integrity standards presented in this document, including the ones referenced above by link to the webpage of the School of Engineering —

  At a general level, you understand that academic integrity in the context of a course taken for credit at an institution of higher education requires an intersection of respect for oneself, one's peers, and one's instructor(s). You understand that a request on the part of your instructor(s) that limits explicitly the resources and timeframe available to complete a graded assessment should be acknowledged and respected as an effort in earnest to provide you with an educational experience that meets the highest standards of excellence.

  The challenges presented to you in the framework of an examination structure are just this – challenges. If taken seriously and overcome without relaxing stipulations or breaking rules outright, they provide the very best course outcomes for you, and they further your intellectual development. Failure to abide by such requests – whether or not it is discovered and litigated by faculty, deans, academic officers, and student councils at the institution – will always undermine your ability to continue your intellectual advancement, by compromising your lifelong learning goals and damaging your ability to give back to others. The consequences are both personal and communal – if the academic integrity of an educational environment is compromised, it hurts not only our ability to distinguish between who has passed and who has failed a class, but much more importantly, to evaluate where everyone is in their studies, so as to provide the best possible and most timely academic support. Please don't do this to yourselves or to each-other.

- **Course Textbooks:**

  # 1 (weeks 1-12) Cuoco, A., Waterman, K. Kerins, B. Kaczorowski, E., Manes, M. *Linear Algebra and Geometry*. AMS/MAA Vol. 46, 2019.

  # 2 (weeks 13-14) Anton, H. *Elementary Linear Algebra*. Ninth Edition. John Wiley & Sons, Inc., 2005.

  Suggested Supplementary Text (for comparison to Chapters 3, 4, & 5 of textbook #1 above):

  – Lay, D. *Linear Algebra and Its Applications*. Fourth Edition. Addison Wesley, 2012.

- **Description and Overview:**

  Brief Description: This course consists of a brief introduction to the elementary properties of two- and three-dimensional vectors (designed to prepare students for facing Calculus II and Vector Calculus at Cooper Union), followed by an introduction to the algorithms for solving linear systems of equations. Time is spent to develop elementary properties of matrices, with a special emphasis on square matrices. The course concludes with a brief introduction to the complex number system and some of its elementary properties.

  Syllabus: Chapters 1–4, and sections 5.1–5.4 & 9.1–9.3 in textbook #1; Sections 10.1-10.3 in textbook #2. Rate ≈ 2.5 sections per week. Further details on Moodle (see: `http://moodle.cooper.edu/`).

Approximate Schedule (week-by-week):

1. Points and vectors (1.1-1.3).
2. Lengths and dot product (1.4-2.4).
3. Projections and angles (2.3-2.5).
4. Cross products, lines and planes (2.5-2.6).
5. Introduction to linear systems (3.1-3.2).
6. Gaussian elimination(3.2-3.3).
7. Linear combinations, linear dependence/independence, kernel of a matrix (3.3-3.5).
8. Adding, multiplying, scaling matrices; different types of square matrices (4.1-4.4).
9. Operations, identity and matrix inversion, applications of matrix algebra (4.5-4.6).
10. Geometric transformations, notations (5.1-5.3).
11. Determinants (5.4, 9.1-9.2).
12. Determinants as area and volume, Cramer's Rule (9.2-9.3).
13. Complex numbers I (10.1 &10.2 (Anton's 9th Edition)).
14. Complex numbers II (10.2 &10.3 (Anton's 9th Edition)).

- **Grading Policy**: As mentioned on the first day of the semester, there will be four components that will be used to determine the final course grade.

  1. Homework will be collected and graded each week (see below for details).
  2. There will be two 50-minute **exams** held according to the approximate schedule outlined below.
  3. The **Final Examination** for the course will be CUMULATIVE. It will be held during the final examination period (this coincides with the last class meeting for the semester).

Assessment	**Format**	**Dates**	**Weight**
Weekly Submissions (number TBD)	15-20 questions, from textbook	throughout	15 %
Exam 1 (1 hr.)	4-5 problems; some with multiple parts	October 15	25 %
Exam 2 (1 hr.)	4-5 problems; some with multiple parts	November 12 or 19 (TBD)	25 %
Final Exam	8-10 problems; some with multiple parts	December 17	35 %

- **Policy on Examinations:** Registered students are required to sit for the course examinations on the scheduled day and time. Failure to do so will result in forfeiture of the percentage credit due for that component.

- **Policy on Medical Absences:** Students who have medical excuses for missing class should contact the Dean of Students promptly. Failure to register a request for a medically excused absence in a timely manner with the Dean of Students may complicate and potentially invalidate the request. Students will be required to provide the Dean of Students with documentation from a medical provider justifying the absence. The Dean of Students will inform me when an absence is due to a valid medical issue/condition so that the absence can be considered excused.

- **Reading and Homework**:

  Reading: You should follow the schedule for covering material (as provided above and on the course webpage) and read sections IN ADVANCE of the lecture (preferably, the night before). This will put you in a good position to follow and absorb the lecture, even while taking notes (which is **highly recommended** for everyone!).

  Homework Structure: In order to foster the formation of study groups and collaboration among you, I will ask you to work on homework problems in groups of 3 each (designated by me, rotating every two weeks). With the exception of the first assignment, which will be due on Thursday September 12 at 8PM (sharp!), weekly homework assignments consisting of 20-30 questions each will be due on **Fridays at 12PM noon (sharp!)**, every week. Late submissions will not be accepted. Each student will be responsible for submitting her/his OWN, NEATLY HAND-WRITTEN SUBMISSION. Each week, I will select 6-9 questions to be graded from the assignment. For each team, I will randomly pair each team member with 2 or 3 of the selected questions and grade her/his work; these grades will then be aggregated so that each team receives a single score for that assignment. You are encouraged to keep corrected records of your manuscripts upon their return to you.

The section-by-section homework is given in the approximate schedule document and will be echoed with live updates throughout the semester on the Moodle page for the course (see: `http://moodle.cooper.edu/`). **You are expected to do each section's assignment as soon as possible – on the evening directly following the class in which it was covered.** These weekly assignments have been formulated with the goal of challenging and preparing you for the graded assessments outlined above. Please be advised that the assessments will be constructed to incorporate material from **every** section covered in the course. If you skip a section of homework, you may lose up to 10% worth of points from the graded work because the material is cumulative – skipping tends to adversely affect future comprehension and performance.

Please make sure to visit my office hours for in-depth, personal, and extended discussions of the material and the homework.

- **Policy on Technology in the Classroom:**

  During regular lectures:

  1. Cellular phones must be placed in **silent/vibrate** mode and stowed away (pocket, book bag, etc. – not visible on desk/table surface, nor obviously in use below desk surface level) throughout class time. I request this as a courtesy to me and will ask you to comply with this request during lecture. I may ask you to leave for the period if I determine that a violation of this request is causing a distraction or otherwise compromising the classroom environment.
  2. Laptops *without tablet functionality* and calculators distract from the main lecture, *even when the laptop screen is primarily displaying course resources or when the calculator is implementing a calculation presently under discussion.* I request that you refrain from bringing either to class.
  3. Tablets and laptops *with tablet functionality* may be used solely for the purposes of taking notes. In order to be in compliance with this policy, I ask that you maintain the gadget in question in a flat position on the desk surface as you write on it.

  During in-class examinations: The use of any computing technology is prohibited during the tests; in particular, calculators are not allowed. The exam questions will not require the use of computing technology, and wherever numerical answers are requested as a final result, I will clarify if decimal approximations/representations are expected (and to what accuracy...); in all such instances, such representations will be obtainable through standard techniques either already known to you or else covered during this course. Please feel free to ask during an exam if you require further clarification regarding a specific problem.

- **Special Accommodations:** Students with disabilities or who need special accommodations for this class are required to meet with me and the Dean of Students immediately so that arrangements can be made. Cooper Union has limited resources and extra time is required for such arrangements to be feasible. In order to receive accommodations for an exam, you must notify me in writing at least two weeks before they are needed, and you must also be registered with the Dean of Students. Students will not be afforded any special accommodations retroactively, i.e., for academic work completed prior to disclosure of the disability to me and the Dean.

- **Further Resources for Students:** (the text below carries appropriate hyperlinks to the College's webpage)

  - **Cooper Union Title IX Policy**
  - **Disability support services**
  - **Counseling and mental health services**