1. Course: MATH 361, Linear Spaces with Applications - Winter 2021
   Lecture 01: MWF 12:00 - 12:50 - Online

   Instructor  Email  Phone  Office  Hours
   Dr. Carlo Maria  carlomaria.scandolo@ucalgary.ca  TBA  MS 584  By appointment, via Zoom

Online Delivery Details:

Some aspects of this course are being offered in real-time via scheduled meeting times. For those aspects you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

Asynchronous lectures on D2L, posted twice per week.

Live optional public office hours for general questions (via Zoom): Fridays 12:00 - 12:50

Course Site:

D2L: MATH 361 L01-(Winter 2021)-Linear Spaces with Applications

Note: Students must use their U of C account for all course correspondence.

2. Requisites:

See section 3.5.C in the Faculty of Science section of the online Calendar.

Prerequisite(s):
Mathematics 311 or a grade of ”B+” or higher in Mathematics 213; and Mathematics 267 or 277.

Antirequisite(s):
Credit for Mathematics 361 and 313 will not be allowed. Also known as: (formerly Mathematics 411)

3. Grading:

The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

<table>
<thead>
<tr>
<th>Component(s)</th>
<th>Weighting %</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 homework assignments</td>
<td>10, equally weighted</td>
<td>24 January, 14 March, 11 April, 25 April</td>
</tr>
<tr>
<td>Midterm</td>
<td>40</td>
<td>Starting 25 February</td>
</tr>
<tr>
<td>Final</td>
<td>50</td>
<td>Scheduled by Registrar</td>
</tr>
</tbody>
</table>

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

<table>
<thead>
<tr>
<th>Minimum % Required</th>
<th>A+</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>C-</th>
<th>D+</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 %</td>
<td>95</td>
<td>90</td>
<td>85</td>
<td>80</td>
<td>75</td>
<td>70</td>
<td>65</td>
<td>60</td>
<td>55</td>
<td>50</td>
<td>45</td>
</tr>
</tbody>
</table>

This course will have a final exam that will be scheduled by the Registrar. The Final Examination Schedule will be published by the Registrar’s Office approximately one month after the start of the term. The final exam for this
course will be designed to be completed within 2 hours.

Homework assignments, midterm and final are submitted through Gradescope, entry code: \texttt{92DBZ9}

The midterm and final are scheduled for a written duration of 2 hours + 1 hour buffer time. Students will be able to access them during a 24-hour window, but once accessed, they must submit their solution within 3 hours.

All exercises and questions in assessed components will be open-ended.

4. Missed Components Of Term Work:

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

5. Scheduled Out-of-Class Activities:

There are no scheduled out of class activities for this course.

6. Course Materials:

   Recommended Textbook(s):

   S. Axler, \textit{Linear Algebra Done Right}: Springer.

   Lecture notes by the instructor will be available on D2L.

   In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

   - A computer with a supported operating system, as well as the latest security, and malware updates;
   - A current and updated web browser;
   - Webcam/Camera (built-in or external);
   - Microphone and speaker (built-in or external), or headset with microphone;
   - Current antivirus and/or firewall software enabled;
   - Stable internet connection.

   For more information please refer to the UofC ELearning online website.

7. Examination Policy:

   No aids are allowed on tests or examinations.

   Students should also read the Calendar, Section G, on Examinations.

8. Approved Mandatory And Optional Course Supplemental Fees:

   There are no mandatory or optional course supplemental fees for this course.

9. Writing Across The Curriculum Statement:

   For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

10. Human Studies Statement:

    Students will not participate as subjects or researchers in human studies.

    See also Section E.5 of the University Calendar.

11. Reappraisal Of Grades:

    A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. \textit{Non-academic grounds are not relevant for grade reappraisals.} Students should be aware that the
grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

a. **Term Work**: The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item’s return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections I.1 and I.2 of the University Calendar.

b. **Final Exam**: The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **Other Important Information For Students**:

a. **Mental Health**: The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).

b. **SU Wellness Services**: For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.

c. **Sexual Violence**: The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208. The complete University of Calgary policy on sexual violence can be viewed at (https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf).

d. **Misconduct**: Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional Code of Conduct and promote academic integrity in upholding the University of Calgary’s reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor’s consent; submitting or presenting work as if it were the student’s own work; submitting or presenting work in one course which has also been submitted in another course without the instructor’s permission; borrowing experimental values from others without the instructor’s approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

   - Student Handbook on Academic Integrity
   - Student Academic Misconduct Policy and Procedure
   - Research Integrity Policy

Additional information is available on the Student Success Centre Academic Integrity page.

e. **Academic Accommodation Policy**: Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at procedure-for-accommodations-for-students-with-disabilities.pdf.

   Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Mathematics & Statistics, Mark Bauer by email bauerm@ucalgary.ca or phone 403-220-4189. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.

f. **Freedom of Information and Privacy**: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.

g. **Student Union Information**: VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: scincerep@su.ucalgary.ca. Student Ombudsman, Email:
h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

**Course Outcomes:**

- prove statements describing basic properties of a field, connecting matrix properties with its eigenvalues, illustrate solution of systems of linear equations over various fields
- describe linear operators in various bases, as well as transition matrices, kernels and images of linear operators, to construct a dual basis for a basis of a finite-dimensional space
- establish similarity of matrices, to identify whether a given square matrix is diagonalizable or not on a given field, and to find a basis, if possible, in which a given operator has a diagonal form, to compute the minimal polynomial and a Jordan form of a linear operator on a finite-dimensional vector space, and to use shortcuts to compute expressions with square block matrices more efficiently
- compute an orthogonal basis of a subspace of an inner product space, to find coefficients of orthogonal expansions, apply Schwarz and triangle inequalities to verify algebraic and functional inequalities
- compute adjoint operators, to identify unitary, Hermitian, positive definite and normal operators
- identify whether two symmetric matrices are congruent, to compute canonical forms and apply positive and negative definiteness of quadratic forms to the analysis of local extrema for functions of several variables;
- compute LU, LDU decomposition of square matrices, as well as QR factorization when the number of columns does not exceed the number of rows, implement Singular Value Decomposition and find a Moore-Penrose pseudoinverse of an arbitrary matrix, as well as apply these methods in numerical analysis, for example, to solve least squares problems