

MATH 307 Applied Linear Algebra

Course Outline 2025W2

Linear systems of equations, LU decomposition, condition number, orthogonal projection, QR decomposition, least squares approximation, orthogonal diagonalization, singular value decomposition, discrete Fourier transform. Applications: interpolation, differential equations, data fitting, principal component analysis, image deblurring, PageRank, digital signal processing. Matrix computations with mathematical software Python, SciPy and Jupyter.

Learning Goals

- Summarize properties and constructions of matrix decompositions LU, QR and SVD
- Perform matrix computations using mathematical software Python, SciPy and Jupyter
- Compute solutions of systems of linear equations using matrix decompositions
- Compute least squares approximations of linear systems using matrix decompositions
- Approximate eigenvalues and eigenvectors using numerical methods
- Analyze digital signals using the discrete Fourier transform
- Create and analyze mathematical models of real-world phenomenon

Instructors

| <i>Name</i> | <i>Office</i> | <i>Email</i> | <i>Office hours</i> |
|--------------------------|---------------|--|--------------------------|
| Gulsemay Yigit (she/her) | PIMS 4112 | gulsemayy@math.ubc.ca | Tuesday 12.30-13.30PM |
| William O' Regan | TBC | Canvas | TBC |

Lectures

| <i>Section</i> | <i>Instructor</i> | <i>Time</i> | <i>Location</i> |
|----------------|-------------------|----------------|---------------------|
| 201 | William O'Regan | MWF 12-1pm | HENN 202 |
| 202 | Gulsemay Yigit | TTh 11-12:30pm | IRC Floor G: Room 4 |

Textbooks

[MATH 307 Applied Linear Algebra](#)

Important Dates

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|--------------------|-----------------------------|
| Monday January 5 | Lectures begin |
| Monday February 16 | Family Day (No Lectures) |
| February 16–20 | Midterm Break (No lectures) |
| Friday April 3 | Good Friday (UBC closed) |
| Monday April 6 | Easter Monday (UBC closed) |
| Friday April 10 | Last day of class |
| April 14–25 | Final exam period |

Canvas and Piazza

Announcements, assignments, grades, lecture recordings and all other course information will be posted on [Canvas](#). Please check it often! Use Piazza to ask and answer questions about lecture notes, textbook exercises, etc. Find the Piazza link on the Canvas course page.

Prerequisites

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|------------------------|---|
| Linear Algebra | One of MATH 152, MATH 221, MATH 223 |
| Multivariable Calculus | One of MATH 200, MATH 217, MATH 226, MATH 253, MATH 254 |

- See the [UBC Course Schedule](#)

Schedule

| Hours | Topics |
|-----------|--|
| 9 | Linear equations. Gaussian elimination, LU decomposition, condition number. Applications: polynomial interpolation, cubic spline interpolation. |
| 10 | Orthogonality. Orthogonal subspaces, fundamental subspaces of a matrix, orthogonal projection, Gram-Schmidt orthogonalization, QR decomposition, least squares approximation. Applications: fitting models to data. |
| 10 | Eigenvalues. Diagonalization, spectral theorem, SVD, pseudoinverse, SVD expansion, power method. Applications: principal component analysis, image deblurring, PageRank. |
| 7 | Discrete Fourier transform. Complex vector spaces, discrete Fourier transform, sinusoids, frequency and phase, fast Fourier transform. Applications: digital signal processing. |
| 36 | |

Assessments

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|--------------------|--------------------------------------|
| Canvas Quizzes | $4 \times 2.5\% \text{ each} = 10\%$ |
| Python Assignments | $4 \times 2.5\% \text{ each} = 10\%$ |
| Midterm Exams | $2 \times 20\% \text{ each} = 40\%$ |
| Final Exam | 40% |

- Multiple attempts and collaboration allowed on Canvas quizzes
- Assignments do not require any prior Python experience
- Midterm exam scheduled during lecture time

Student Resources

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|---------------------|----------------------|--------------------------|
| Science Advising | Health and Wellbeing | Centre for Accessibility |
| Academic Concession | Academic Integrity | Counselling Services |

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the [UBC Senate website](#).