

# ECE/Math 520: General Course Information

## Instructor

Prof. Ali Pezeshki

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Office: Engineering C103F

## Classroom Sessions

Room: Engr B103, T R 11:00-12:15pm.

For online participation, [see Zoom link here](#)

## Brief Course Description

- Theory of unconstrained and constrained optimization
- Necessary and sufficient optimality conditions
- Algorithms and search methods for optimization, and their analysis
- Examples from various engineering applications

## Course Learning Objectives

By the time the students successfully complete the course, they should be able to:

1. Analyze optimization problems to determine appropriate solution methods, including applying analytical and numerical methods.
2. Apply necessary conditions and sufficient conditions for optimality.
3. Analyze optimization algorithms in terms of properties including descent, convergence, and order of convergence.
4. Make precise statements about optimization problems and their solutions.

Each module will have its own learning objectives related to these course objectives.

## Prerequisites

- Undergraduate linear algebra.
- Undergraduate multivariable calculus.

## Textbook

- E. K. P. Chong, W.-S. Lu, and S. H. Żak, [\*An Introduction to Optimization \(with Applications to Machine Learning\)\*](#), Fifth Edition, New York, NY: John Wiley & Sons,

Inc. (Wiley-Interscience Series), 2023, ISBN: 978-1-119-87763-9, ISBN-10: 1119877636.

- There is no requirement to purchase your textbook from any particular vendor or in any particular format (e-book, softcover, hardcover, etc.). As long as it works well for you, it's fine.

## **Workload**

Because this is a three-credit course, the standard expectation is that you spend 10-12 hours total on average each week. The modules, readings, homework sets, and tests are designed so that the workload is spread out throughout the semester in a manageable way. You will have ample time to complete them because the available time is generous. Nonetheless, some students have reported that this is a challenging course because it requires a lot of thinking.

## **Grading**

- Homework: 10%; Assigned Weekly.
- Test 1: 30%; Modules 1-7, Take-home; Released on Feb. 29. Due Mar. 1 at 11AM MST.
- Test 2: 30%; Modules 9-12, Take-home; Released on Apr. 4; Due Apr. 5 at 11AM MDT.
- Test 3: 30%; Modules 13-16, Take-home; Released on May 2; Due May 3 at 11AM MDT.

## **Assessment Approach**

The homework sets and tests are all designed to help you learn and master the material in this course. There are two types of homework questions:

1. Questions that ask you to perform straightforward tasks related to the material. These are designed to ensure that you have basic experience in working with the types of problems involved. They are typically easy to answer.
2. Questions that ask you to perform challenging tasks. They are designed to prompt you to think hard about the material and synthesize integrative knowledge. These questions are typically more difficult to answer than the first type (above), take more thinking time, and will assess your mastery of the material. Moreover, they have high pedagogical value because they prompt you to go through the process of consolidating your thinking, knowledge, and skills. They are also designed to ensure that you will learn something new by the time you complete them.

The test questions will focus mainly on the second type because they are meant to consolidate your learning and to test your mastery of the subject matter. The bulk of your final grade is based on the tests (almost 30% each).

## **Office Hours**

Scheduled times: T R 12:30-1:15pm (except when there is a schedule conflict).

Feel free to email me any time: [ali.pezeshki@colostate.edu](mailto:ali.pezeshki@colostate.edu)

## Examples of Applications

- Engineering design
  - Data sciences
  - Machine learning
  - Robotics and artificial intelligence
  - Communication systems
  - Control systems
  - Signal and image processing
  - Computer systems
  - Information theory
  - Biological processes
  - Manufacturing systems
  - Finance and investment planning
  - Economics
  - Decision making
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## ECE/Math 520: Course Topics

- Module 1: Introduction and Mathematical Preliminaries
  - Module 2: Set Constraints
  - Module 3: One-Dimensional Search
  - Module 4: Gradient Methods
  - Module 5: Newton's Method
  - Module 6: Conjugate Direction Methods
  - Module 7: Quasi-Newton Methods
  - Module 8: Randomized Search
  - Module 9: Constrained Search
  - Module 10: Least-Squares Problems
  - Module 11: Linear Programming
  - Module 12: Simplex Method
  - Module 13: Duality in LP
  - Module 14: Equality Constraints in NLP
  - Module 15: Inequality Constraints in NLP
  - Module 16: Convex Optimization
  - Module 17: Lagrangian Duality in NLP
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# ECE/Math 520: Course Policies

## CSU Honor Pledge ([link](#))

- Past tense: HONOR PLEDGE: "I have not given, received, or used any unauthorized assistance."
- Future tense: HONOR PLEDGE: "I will not give, receive, or use any unauthorized assistance."

## Working together

Working together on general study is encouraged. Of course, any assignment or exam you turn in *must be solely your own work*. Academic dishonesty has serious consequences (see below).

## Disabilities

Colorado State University is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations must first contact Student Disability Center (SDC; <https://disabilitycenter.colostate.edu>) before requesting accommodations for this class. Students who need accommodations in this course must contact the instructor in a timely manner (at least one week before exams) to discuss needed accommodations.

## Academic integrity

The faculty expects every member of the CSU community to practice honorable and ethical behavior both inside and outside the classroom. This course will adhere to the CSU Academic Integrity Policy as found on the Student' Responsibilities page of the CSU General Catalog and in the Student Conduct Code. By handing in homework, quizzes, and tests/exams, you certify that this is your own work. Any actions that might unfairly improve a student's score on homework, quizzes, tests, or examinations will be considered academic misconduct and will not be tolerated. Examples of academic misconduct include (but are not limited to):

- Sharing results or other information for a assignments (quiz, homework, test, etc.).
- Using forbidden material or devices.
- Submitting assignments that is not your own work or engaging in forbidden homework collaborations.
- Representing as your own work anything taken from the work of someone else. This includes all material that you did not create yourself. If you wish to quote or use something that you did not create, you must acknowledge it by including the exact source information (e.g., a URL or a reference to the source, such as "Idea taken from Example 6.8 in Chong-Lu-Zak.").
- Using answers to questions posted online.

**Important:** The use of online “homework helper” sites including, but not limited to, Chegg, NoteHall, Quizlet and Koofers is not permitted. Use of these types of resources will be

considered receiving unauthorized assistance and, therefore, a violation of the student conduct code.

At the professor's discretion, academic misconduct will result in a reduced score, a zero score, a failing grade for the course, and reporting to the CSU Student Resolution Center (and may result in additional University disciplinary action; if you are an international student, such disciplinary action could result in drastic consequences, such as losing your student-visa status). If there is any question as to whether a given action might be construed as academic misconduct, please contact the professor before you engage in any such action.

For more information, please see CSU's page on [Academic Honesty and Integrity](#). For information on the Honor Pledge, see the [Honor Pledge](#).

## **Diversity, Equity, and Inclusion**

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you. All students are expected to contribute to a respectful, welcoming, and inclusive environment.

## **Mental Health and Wellness**

CSU is a community that cares. You are not alone. CSU Health Network Counseling Services has trained professionals who can help. Your student fees provide access to a wide range of support services.

Call Counseling Services at (970) 491-6053, and they will work together with you to find out which services are right for you.

Visit <https://health.colostate.edu/about-counseling-services> to learn more and <https://health.colostate.edu/mental-health-resources/> for additional student mental health and well-being resources. An extensive set of mental health resources is available to CSU students:

If you are concerned about a friend or peer, use **Tell Someone** by calling (970) 491-1350 or visiting <https://supportandsafety.colostate.edu/tell-someone/> to share your concerns with a professional who can discreetly connect the distressed individual with the proper resources. Rams Take Care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.