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ECE 503 - Ultrafast Optics

Course Details

Instructor: Randy A. Bartels

Office: B316 Scott Bioengineering

Office Hours: By appointment

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Phone: (970) 491-8971

Classroom information:

Lecture: 2:00 pm - 3:15 pm , Tu/Th, B2 Engineering

Online lecture posted by 5:00 pm

COVID-19

Important information for students:

Masks are required inside university buildings. You must also meet university vaccine or exemption requirements.

All students are expected and required to report to the COVID Reporter

(<https://covid.colostate.edu/reporter/> [\(https://covid.colostate.edu/reporter/\)](https://covid.colostate.edu/reporter/)) **when:**

- You suspect you have symptoms of COVID, regardless of whether or not you are vaccinated and even if your symptoms are mild
- You have tested positive for COVID through a non-CSU testing site, such as home test or test at a pharmacy
- You believe you may have been exposed to COVID go to the COVID Reporter and follow the guidance under "I believe I have been in close contact with someone who has COVID-19." This guidance will depend upon your individual circumstances


You will not be penalized in any way for reporting symptoms or concerns.

Do not ask me as your instructor to report for you. It is your responsibility to report through the COVID Reporter promptly.

As your instructor I may not ask you about vaccination status or if you have COVID but you may freely volunteer to send me information from a public health official - if you have been asked to isolate or quarantine.

When you complete the COVID Reporter, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600.

For the latest information about the University's COVID resources and information, including FAQs about the spring semester, please visit the **CSU COVID-19 site**<https://covid.colostate.edu/> 
(<https://covid.colostate.edu/>).

Course Description

The objective of this course is to provide students with a fundamental background in optical interactions in biological systems and tissues and to provide the students with an understanding of the capabilities and limitations of the use of optics and lasers in medicine and biology. Fundamental concepts of optics and laser-tissue interaction will be discussed in order to provide a basis for the understanding of the current technology. Successful students will be able to evaluate the capabilities of optical spectroscopic and imaging tools for evaluating physiological condition, health, and behavior of biological systems. They will be able to evaluate and interpret data from biomedical optical measurements, and design optical instrumentation for medical applications.

Textbook

Mathematica for students: <https://www.wolfram.com/mathematica/pricing/students/> 
(<https://www.wolfram.com/mathematica/pricing/students/>)

There is a single semester option

AND

Ultrafast Optics

by Andrew Weiner, John Wiley & Sons, Inc.

First published:28 October 2008

Print ISBN:9780471415398 |Online ISBN:9780470473467 |DOI:10.1002/9780470473467

<https://onlinelibrary.wiley.com/doi/book/10.1002/9780470473467> 

(<https://onlinelibrary.wiley.com/doi/book/10.1002/9780470473467>)

References

- Ultrashort Laser Pulse Phenomenon: Fundamentals, Techniques, and Applications on a Femtosecond Time Scale, 2nd edition, J. -C. Diels and W. Rudolph, Academic, 2006.
- Femtosecond Optical Frequency Comb: Principle, Operation, and Applications, Jun Ye and Steven T. Cundiff (Ed.), Kluwer Academic Publishers / Springer, 2004.
- Optics of Femtosecond Laser Pulses, S.A. Akhmanov, V.A. Vysloukh, and A.S. Chirkin, American Institute of Physics, 1992.
- Lasers, A.E. Siegman, University Science Books, Mill Valley, 1986.
- Nonlinear Fiber Optics, G.P. Agrawal, Academic, 1995.
- Frequency Resolved Optical Gating: The measurement of ultrashort laser pulses, R. Trebino, Kluwer Academic Publishers, 2002.
- Few-Cycle Laser Pulse Generation and Its Applications, F.X. Kartner (ed.), Springer, 2004.
- Ultrafast Lasers Technology and Applications, M.E. Fermann, A. Galvanauskas, and G. Sucha (eds.), Marcel Dekker, 2003.
- Compact Sources of Ultrashort Laser Pulses, I.N. Duling (ed.), Cambridge, 1995.
- Femtosecond Laser Pulses , C. Rulliere (ed.), Springer, 2002.
- Ultrashort Laser Pulses and Applications, W. Kaiser (ed.), Springer, 1993.

Course Schedule

Week	Topic	Preparation for Class	Assignments Due
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		Class	Due
Week 1	L01 - What and Why Ultrafast L02: Ultrafast Laser Pulses and Dispersion	Read Syllabus Read Chapter 1, Section 4.1 Lecture 01 Slides Lecture 02 Slides	Quiz01
Week 2	Mathematica Examples with Ultrafast Pulses L03: Ultrafast Laser Pulse Characterization A	Read Chapter 3 Lecture 03 Slides	Quiz02 and HW01
Week 3	L04: Ultrafast Laser Pulse Characterization B L05: Ultrafast Laser Pulse Propagation	Lecture 04 Slides Lecture 05 Slides	Quiz03 and HW02
Week 4	L06: Dispersion and Dispersion Control A L07: Dispersion and Dispersion Control B	Read Chapter 4 Lecture 06 Slides Lecture 07 Slides	Quiz04 and HW03
Week 5	L08: Diffraction and Scattering of Ultrafast Pulses A L09: Diffraction and Scattering of Ultrafast Pulses B	Lecture 08 Slides Lecture 09 Slides	Quiz05 and HW04
Week 6	Mathematica Pulse Propagation, Diffraction, and Scattering Examples L10: Ultrafast Pulse Shaping	Read Chapter 8 Lecture 10 slides	Quiz06 and HW05

Week 7	Exam #1 Review Exam #1		Exam #1
Week 8	L11: Ultrafast Light-Matter Interactions L12: Nonlinear Optics of Ultrafast Laser Pulses A	Read Chapter 5 Read Chapter 9 Read Section 6.1 Lecture 11 slides Lecture 12 slides	Quiz07 and HW06
Week 9	Spring Break	Spring Break	Spring Break
Week 10	L13: Nonlinear Optics of Ultrafast Laser Pulses B L14: Nonlinear Optics of Ultrafast Laser Pulses C	Read Chapter 6 Lecture 13 slides Lecture 14 slides	Quiz08 and HW07
Week 11	L15: Soliton Propagation in Fibers L16: Ultrafast laser sources A	Read Chapter 6 Lecture 15 slides Lecture 16 slides	Quiz09 and HW08
Week 12	Review for Exam #2 Exam #2		Exam #2
Week 13	L17: Ultrafast laser sources B	Read Chapter 6 Lecture 17 slides	Quiz10 and HW09

	L18: Ultrafast laser sources C	Lecture 18 slides	
Week 14	L19: Coherent and dephasing spectroscopies L20: Ultrafast Frequency Comb Metrology	Read Chapter 6 Lecture 19 slides Lecture 20 slides	Quiz11 and HW10
Week 15	L21: Ultrafast Frequency Comb Spectroscopy L22: Dual Comb Sources and Spectroscopy	Read Chapter 6 Lecture 21 slides Lecture 22 slides	Quiz12 and HW11
Week 16	L23: Terahertz sources, spectroscopy, and imaging Review for the final	Read Chapter 6 Lecture 23 slides	Quiz13 and HW12

Exam Dates

Midterm 1: March 3, 2022

Midterm 2: April 7, 2022

Final Exam: Tuesday, May 10, 2022, 6:20-8:20 pm

Software

Mathematica is required for this course.

Mathematica Tutorials

Nice Book: <https://arxiv.org/pdf/1403.7050.pdf> pdf (<https://arxiv.org/pdf/1403.7050.pdf>)

<https://www.wolfram.com/language/fast-introduction-for-math-students/en/> [\(https://www.wolfram.com/language/fast-introduction-for-math-students/en/\)](https://www.wolfram.com/language/fast-introduction-for-math-students/en/)

Wolfram site: <https://www.wolfram.com/language/fast-introduction-for-math-students/en/> [\(https://www.wolfram.com/language/fast-introduction-for-math-students/en/\)](https://www.wolfram.com/language/fast-introduction-for-math-students/en/)

<https://pages.mtu.edu/~msgocken/pdebook2/mathtut2.pdf> [↗](https://pages.mtu.edu/~msgocken/pdebook2/mathtut2.pdf)
[\(https://pages.mtu.edu/~msgocken/pdebook2/mathtut2.pdf\)](https://pages.mtu.edu/~msgocken/pdebook2/mathtut2.pdf)

<http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf> [↗](http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf)
[\(http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf\)](http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf)

<https://www.cfm.brown.edu/people/dobrush/am33/Mathematica/index.html> [↗](https://www.cfm.brown.edu/people/dobrush/am33/Mathematica/index.html)
[\(https://www.cfm.brown.edu/people/dobrush/am33/Mathematica/index.html\)](https://www.cfm.brown.edu/people/dobrush/am33/Mathematica/index.html)

<https://www.cfm.brown.edu/people/dobrush/am34/Mathematica/index.html> [↗](https://www.cfm.brown.edu/people/dobrush/am34/Mathematica/index.html)
[\(https://www.cfm.brown.edu/people/dobrush/am34/Mathematica/index.html\)](https://www.cfm.brown.edu/people/dobrush/am34/Mathematica/index.html)

<https://mresources.github.io/tutorial/> [↗](https://mresources.github.io/tutorial/) [\(https://mresources.github.io/tutorial/\)](https://mresources.github.io/tutorial/)

<https://site.uvm.edu/mathematica/> [↗](https://site.uvm.edu/mathematica/) [\(https://site.uvm.edu/mathematica/\)](https://site.uvm.edu/mathematica/)

<https://people.math.harvard.edu/computing/math/tutorial/index.html> [↗](https://people.math.harvard.edu/computing/math/tutorial/index.html)
[\(https://people.math.harvard.edu/computing/math/tutorial/index.html\)](https://people.math.harvard.edu/computing/math/tutorial/index.html)

<https://tutorial.math.lamar.edu/> [↗](https://tutorial.math.lamar.edu/) [\(https://tutorial.math.lamar.edu/\)](https://tutorial.math.lamar.edu/)

https://12000.org/my_notes/faq/mma_notes/MMA.htm [↗](https://12000.org/my_notes/faq/mma_notes/MMA.htm)
[\(https://12000.org/my_notes/faq/mma_notes/MMA.htm\)](https://12000.org/my_notes/faq/mma_notes/MMA.htm)


<https://courses.washington.edu/ph227814/228/nb/> [↗](https://courses.washington.edu/ph227814/228/nb/)
[\(https://courses.washington.edu/ph227814/228/nb/\)](https://courses.washington.edu/ph227814/228/nb/)

Online Resources

Biology and Biological Optics Resources

Lectures on biology and techniques: <https://www.ibiology.org/biology-online/> [↗](https://www.ibiology.org/biology-online/)
[\(https://www.ibiology.org/biology-online/\)](https://www.ibiology.org/biology-online/)

Quantitative Biological Imaging (good lectures): <https://www.quantitativebioimaging.com/>
[\(https://www.quantitativebioimaging.com/\)](https://www.quantitativebioimaging.com/)

Biology numbers: <https://bionumbers.nms.harvard.edu/search.aspx> 
(<https://bionumbers.hms.harvard.edu/search.aspx>)

Biology numbers: <http://book.bionumbers.org>  (<http://book.bionumbers.org>)


Optics and Physics Resources

Online optics textbook: <https://optics.byu.edu/home>  (<https://optics.byu.edu/home>)

Online physics textbook: <https://opentextbc.ca/universityphysicsv3openstax/> 
(<https://opentextbc.ca/universityphysicsv3openstax/>)

Hyperphysics: <http://hyperphysics.phy-astr.gsu.edu/hbase/index.html>  (<http://hyperphysics.phy-astr.gsu.edu/hbase/index.html>)

Introduction to Scattering:

<https://www.youtube.com/watch?v=IU-QEm-2hFs>  (<https://www.youtube.com/watch?v=IU-QEm-2hFs>)



(<https://www.youtube.com/watch?v=IU-QEm-2hFs>)

<https://www.youtube.com/watch?v=f6sHn3pyAro>  (<https://www.youtube.com/watch?v=f6sHn3pyAro>)



(<https://www.youtube.com/watch?v=f6sHn3pyAro>)

Virtual photonics: <https://virtualphotonics.org/>  (<https://virtualphotonics.org/>)

Scattering and absorption spectroscopy: <https://omlc.org/~prahl/>  (<https://omlc.org/~prahl/>)

NIST chemistry and spectroscopy database: <https://webbook.nist.gov/chemistry/> 

[\(https://webbook.nist.gov/chemistry/\)](https://webbook.nist.gov/chemistry/)

Thorlabs technical guides: https://www.thorlabs.com/navigation.cfm?guide_id=2474 ↗

https://www.thorlabs.com/navigation.cfm?guide_id=2474

Computational Imaging

Computational Imaging Lecture Series: <https://sites.google.com/view/sps-space> ↗

<https://sites.google.com/view/sps-space>

Diffuse Optical Spectroscopic Imaging (DOSI): <https://vimeo.com/88174807> ↗

<https://vimeo.com/88174807>

Diffuse Imaging:

<https://www.youtube.com/watch?v=fKMghVWOoA0> ↗ <https://www.youtube.com/watch?v=fKMghVWOoA0>

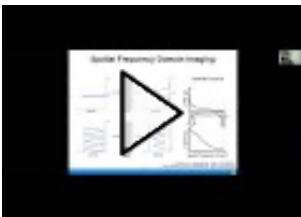
<https://www.youtube.com/watch?v=fKMghVWOoA0>



<https://www.youtube.com/watch?v=fKMghVWOoA0>

Spatial Frequency Domain Imaging:

<https://www.youtube.com/watch?v=l3l9-pfLI4o> ↗ <https://www.youtube.com/watch?v=l3l9-pfLI4o>



<https://www.youtube.com/watch?v=l3l9-pfLI4o>

Microscope (and optics) Resources

Olympus Microscope Resource Center: <https://www.olympus-lifescience.com/en/microscope-resource/> <https://www.olympus-lifescience.com/en/microscope-resource/>

Nikon MicroscopyU: <https://www.microscopyu.com/> (<https://www.microscopyu.com/>)

UofA Microscopy Resources: <https://microscopy.arizona.edu/learn/microscopy-imaging-resources-www> (<https://microscopy.arizona.edu/learn/microscopy-imaging-resources-www>)

ImageJ: <https://imagej.nih.gov/ij/> (<https://imagej.nih.gov/ij/>)

Molecular Expressions Primer: <https://micro.magnet.fsu.edu/primer/> (<https://micro.magnet.fsu.edu/primer/>)

Royal Microscopical Society: <https://www.rms.org.uk/study-read/news-listing-page/online-microscopy-talks-list.html> [↗](#) (<https://www.rms.org.uk/study-read/news-listing-page/online-microscopy-talks-list.html>)

Fluorescence tutorials: <https://www.thermofisher.com/us/en/home/support/tutorials.html> [↗](#) (<https://www.thermofisher.com/us/en/home/support/tutorials.html>)

Weekly Canvas Quizzes

There will be a weekly quiz on Canvas. For this quiz, you will answer several questions that require either a numerical answer or a formula answer. You will have infinite attempts at providing the answer so that, hopefully, everyone is successful with these quizzes. In addition to the answer, you will need to upload a written out answer that explains how you computed your result(s) for the quiz solution as part of the homework assignments. Details of the formatting requirements for homework are provided below.

Assignments and Canvas

I will post all assignments on Canvas, and all assignments must be submitted through Canvas.

All assignments will be submitted as a pdf file and will be prepared either in Mathematica, LaTeX, or a similar program so that all responses are typeset. All code used for calculation must be submitted in the pdf.

It is expected that you will use the following format for submitting all assignments:

LAST.FIRST.ASSIGNMENT.pdf

For example: Bartels.Randy.HW01.pdf

Homework Policy

The homework is an essential part of the course. You should attempt all problems yourself, but feel free to argue with your colleagues about them. (Simply copying each other's solutions is, however, counterproductive for all parties and is not acceptable.)

A few of the problems will be numerical, not involving heavy computation, but more in the way of modeling pulse propagation through various dispersive elements, so you will need to use your favorite math package (e.g., Mathcad, Maple, Matlab, Mathematica, IDL, etc.).

To clarify, a homework solution MUST include a full explanation of how the problem is set up, the motivation of steps in the analysis, and an interpretation of the results. The entire point of homework is to explore and think about the material presented in the class AND to be able to communicate your findings. The ability to communicate scientific ideas is of critical importance. Moreover, the emphasis of homework is to analyze each physical situation, interpret that analysis, and communicate the meaning. As a result, the emphasis is NOT on algebraic manipulations.

You are encouraged to use Mathematica (and to a MUCH lesser extent other mathematical tools) to write up your solution. All solutions MUST be in a highly simplified form that YOU interpret correctly. Remember: each homework solution should be a short story that includes a reproduction of appropriate diagrams and may require plots of the final solutions you find to explain behaviors.

Homework Formatting Requirements

All homework assignments must be submitted in narrative form. Consider each answer a short essay or paper. In all instances, you should provide a quick background and motivation in the context of Optical Microscopy and then develop your answer to the questions while explaining each step. Below are notes on writing and formatting requirements:

These notes are adapted from Stephen Boyd et al.:

https://web.stanford.edu/class/ee364b/latex_templates/template_notes.pdf
(https://web.stanford.edu/class/ee364b/latex_templates/template_notes.pdf)

You will likely find that when you write out a detailed explanation on a question, you will find that there are gaps in your understanding and thought process. The process of writing out a full explanation will help you clarify your thought and understanding.

John von Neumann once said, "There's no sense in being precise when you don't even know what

you're talking about," and Niels Bohr wrote, "Never express yourself more clearly than you can think." Keep these in mind.

Write in good english: Always write good English, even when the subject that you are discussion contains mathematics. This includes correct grammar, word choice, punctuation, spelling, phrasing, and common sense. A classic on this topic, only slightly dated, is Strunk and White [1].

Keep the reader in mind: Perhaps the most important principle of good writing is to keep the reader in mind: What do they know so far? What do they expect next and why? Do they have sufficient motivation for stated results? As part of this, make sure you know what level of reader you are writing for and stay consistent with that level. If the reader is expected to know microscopy, do not keep defining standard concepts like numerical aperture (you will know this well before the end of the course if you don't already know about this)!

Write to allow skipping over formulas: Many readers will first read through the paper ignoring or skipping all but the simplest formulas. Your sentences and overall report should flow smoothly, and make sense, when all but the simplest formulas are replaced by "blah" or a similar placeholder. As a related point, do not simply display a list of formulas or equations in a row; tie the concepts together with a running commentary.

Online Course Details

All lectures will be available online and simultaneous participation will be available with Zoom.

Late Policy

You are expected to manage your schedule and meet all assigned deadlines. Items turned in within 24 hours after a deadline will receive a 25% penalty. Items turned in 24-48 hours late will receive a 50% penalty. Items submitted more than 48 hours late will not be accepted. Any exceptions must be approved in advance. Late submission is not allowed for the final exam.

Honor Pledge

For all work in this course, it is assumed that the following statement is true: I will not give, receive, or use any unauthorized assistance. The exception is that students may discuss approaches and clarifications regarding homework problems. In fact, this is highly encouraged and you may learn a lot from your peers and from helping your peers.

Professionalism and Academic Integrity

This course will adhere to the CSU Academic Integrity Policy as found on the Student' Responsibilities page of the [CSU General Catalog \(http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity\)](http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity) and in the [Student Conduct Code. \(https://resolutioncenter.colostate.edu/wp-content/uploads/sites/32/2018/08/Student-Conduct-Code-v2018.pdf\)](https://resolutioncenter.colostate.edu/wp-content/uploads/sites/32/2018/08/Student-Conduct-Code-v2018.pdf)

For more details on academic integrity, please read [Practicing Academic Integrity. \(http://learning.colostate.edu/integrity/index.cfm\)](http://learning.colostate.edu/integrity/index.cfm)

At a minimum, violations will result in a grading penalty in this course and a report to the Office of Student Resolution Center.

References

[1] W. Strunk and E. White. The Elements of Style. Macmillan, 1957.

Matlab and Tutorials

CSU Matlab install (and tutorials): <https://www.mathworks.com/academia/tah-portal/colorado-state-university-40638290.html> [↗](https://www.mathworks.com/academia/tah-portal/colorado-state-university-40638290.html) (<https://www.mathworks.com/academia/tah-portal/colorado-state-university-40638290.html>)

A list of tutorials: <http://engineering.nyu.edu/mechatronics/vkapila/matlabtutor.html> [↗](http://engineering.nyu.edu/mechatronics/vkapila/matlabtutor.html) (<http://engineering.nyu.edu/mechatronics/vkapila/matlabtutor.html>)

Matlab tutorials for image processing:

http://www.audentia-gestion.fr/Matlab/Matlab-Image_Processing_Tutorial.pdf [↗](http://www.audentia-gestion.fr/Matlab/Matlab-Image_Processing_Tutorial.pdf) (http://www.audentia-gestion.fr/Matlab/Matlab-Image_Processing_Tutorial.pdf)

<http://apps.usd.edu/coglab/schieber/psyc707/pdf/2D-FFT.pdf> [↗](http://apps.usd.edu/coglab/schieber/psyc707/pdf/2D-FFT.pdf) (<http://apps.usd.edu/coglab/schieber/psyc707/pdf/2D-FFT.pdf>)

http://mstrzel.eletel.p.lodz.pl/mstrzel/pattern_rec/fft_ang.pdf [↗](http://mstrzel.eletel.p.lodz.pl/mstrzel/pattern_rec/fft_ang.pdf) (http://mstrzel.eletel.p.lodz.pl/mstrzel/pattern_rec/fft_ang.pdf)

http://users.cs.cf.ac.uk/Dave.Marshall/CM2208/LECTURES/CM2208_Fourier_Transforms_01_Th [↗](http://users.cs.cf.ac.uk/Dave.Marshall/CM2208/LECTURES/CM2208_Fourier_Transforms_01_Theory.pdf) (http://users.cs.cf.ac.uk/Dave.Marshall/CM2208/LECTURES/CM2208_Fourier_Transforms_01_Theory.pdf)

https://uwaterloo.ca/institute-for-quantum-computing/sites/ca.institute-for-quantum-computing/files/uploads/files/mathematics_qm_v21.pdf ↗ [_ \(https://uwaterloo.ca/institute-for-quantum-computing/sites/ca.institute-for-quantum-computing/files/uploads/files/mathematics_qm_v21.pdf\)](https://uwaterloo.ca/institute-for-quantum-computing/sites/ca.institute-for-quantum-computing/files/uploads/files/mathematics_qm_v21.pdf)

↗ [_ \(http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf\)](http://www2.eng.ox.ac.uk/~labejp/Seminar/Mathematica/MathematicaSeminarNotes.pdf)

Course Information

Canvas is the where course content, grades, and communication will reside for this course.

Login: canvas.colostate.edu ↗ [_ \(http://canvas.colostate.edu/\)](http://canvas.colostate.edu/)

Support: info.canvas.colostate.edu ↗ [_ \(https://canvas.colostate.edu/support/\)](https://canvas.colostate.edu/support/)

For passwords or any other computer-related technical support, contact the [Central IT Technical Support Help Desk](http://lib.colostate.edu/services/computers/technical-support-helpdesk) ↗ [_ \(http://lib.colostate.edu/services/computers/technical-support-helpdesk\)](http://lib.colostate.edu/services/computers/technical-support-helpdesk).

Voice: (970) 491-7276

Email: help@colostate.edu (<mailto:help@colostate.edu>)

The [Technical Requirements](https://www.online.colostate.edu/current-students/technical-support-and-requirements/) ↗ [_ \(https://www.online.colostate.edu/current-students/technical-support-and-requirements/\)](https://www.online.colostate.edu/current-students/technical-support-and-requirements/) page identifies the browsers, operating systems, and plugins that work best with Canvas.

Further information about Academic Integrity is available at CSU's [Academic Integrity - Student Resources](https://tilt.colostate.edu/Integrity/StudentResources) ↗ [_ \(https://tilt.colostate.edu/Integrity/StudentResources\)](https://tilt.colostate.edu/Integrity/StudentResources).

Universal Design for Learning/Accommodation of Needs

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

If you are a student who will need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner. A verifying memo from [The Student Disability Center](https://disabilitycenter.colostate.edu/) ↗ [_ \(https://disabilitycenter.colostate.edu/\)](https://disabilitycenter.colostate.edu/) may be required before any accommodation is provided.

The Student Disability Center (SDC) has the authority to verify and confirm the eligibility of students with disabilities for the majority of accommodations. While some accommodations may be provided by other departments, a student is not automatically eligible for those accommodations unless their disability can be verified and the need for the accommodation confirmed, either through SDC or

through acceptable means defined by the particular department. Faculty and staff may consult with the SDC staff whenever there is doubt as to the appropriateness of an accommodative request by a student with a disability.

The goal of SDC is to normalize disability as part of the culture of diversity at Colorado State University. The characteristic of having a disability simply provides the basis of the support that is available to students. The goal is to ensure students with disabilities have the opportunity to be as successful as they have the capability to be.

Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific physical or mental health conditions due to epilepsy, diabetes, asthma, AIDS, psychiatric diagnoses, etc. Students who are temporarily disabled are also eligible for support and assistance.

Any student who is enrolled at CSU, and who self-identifies with SDC as having a disability, is eligible for support from SDC. Specific accommodations are determined individually for each student and must be supported by appropriate documentation and/or evaluation of needs consistent with a particular type of disability. SDC reserves the right to ask for any appropriate documentation of disability in order to determine a student's eligibility for accommodations as well as in support for specific accommodative requests. The accommodative process begins once a student meets with an accommodation's specialist in the SDC.

Undocumented Student Support

Any CSU student who faces challenges or hardships due to their legal status in the United States and believes that it may impact their academic performance in this course is encouraged to visit [Student Support Services for Undocumented, ACA & ASSET](https://undocumented.colostate.edu/) [↗] [\(https://undocumented.colostate.edu/\)](https://undocumented.colostate.edu/) for resources and support. Additionally, only if you feel comfortable, please notify your professor so they may pass along any additional resources they may possess.

Food Insecurity

Any CSU student (along with faculty and staff) who is experiencing food insecurity can receive support from the [Rams Against Hunger](https://isc.colostate.edu/slice/slice-engagement/rams-against-hunger/) [↗] [\(https://isc.colostate.edu/slice/slice-engagement/rams-against-hunger/\)](https://isc.colostate.edu/slice/slice-engagement/rams-against-hunger/) program. Services include a food pantry, a meal-swipe program, pocket pantries, and in-person assistance with navigating federal aid eligibility. The RAH page includes numerous resources as well as county, state and federal programs which are described and linked.

Title IX/Interpersonal Violence

For the full statement regarding role and responsibilities about reporting harassment, sexual harassment, sexual misconduct, domestic violence, dating violence, stalking, and the retaliation policy please go to: [Title IX – Sexual Assault, Sexual Violence, Sexual Harassment](http://oeo.colostate.edu/title-ix-sexual-assault) [ⓘ](http://oeo.colostate.edu/title-ix-sexual-assault) (<http://oeo.colostate.edu/title-ix-sexual-assault>).

If you feel that your rights have been compromised at CSU, several resources are available to assist:

- Student Resolution Center, 200 Lory Student Center, 491-7165
- Office of Equal Opportunity, 101 Student Services, 491-5836

A note about interpersonal violence: If you or someone you know has experienced sexual assault, relationship violence and/or stalking, know that you are not alone. As instructors, we are required by law to notify university officials about disclosures related to interpersonal violence. Confidential victim advocates are available 24 hours a day, 365 days a year to provide support related to the emotional, physical, physiological and legal aftermath of interpersonal violence. Contact the Victim Assistance Team at: 970-492-4242.

Religious Observances

CSU does not discriminate on the basis of religion. Reasonable accommodation should be made to allow individuals to observe their established religious holidays.

Please see [CSU's Religious Observances Calendar](https://calendar.colostate.edu/observances/) [ⓘ](https://calendar.colostate.edu/observances/) (<https://calendar.colostate.edu/observances/>).

Students seeking an exemption from attending class or completing assigned course work for a religious holiday will need to fill out the [Religious Accommodation Request Form](https://studentaffairs.colostate.edu/resources/resources-faculty-staff/administrative-information/religious-holidays/) [ⓘ](https://studentaffairs.colostate.edu/resources/resources-faculty-staff/administrative-information/religious-holidays/) (<https://studentaffairs.colostate.edu/resources/resources-faculty-staff/administrative-information/religious-holidays/>) and turn it in to the Division of Student Affairs, located on the second level of the Administration building.

Once turned in, the Division of Student Affairs will review the request and contact the student accordingly. If approved, the student will receive a memo from the Dean of Students to give to their professor or course instructor.

Students are asked to turn in the request forms as soon as the conflict is noticed. Similarly, unanticipated conflicts requiring a religious observance, such as a death in the family, can also be reviewed.

CSU Principles of Community

Inclusion: We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.

Integrity: We are accountable for our actions and will act ethically and honestly in all our interactions.

Respect: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.

Service: We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.

Social Justice: We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Diversity and Inclusion

Respect for Diversity: 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. - [Source](https://www.brown.edu/sheridan/teaching-learning-resources/inclusive-teaching/statements)

☞ [\(https://www.brown.edu/sheridan/teaching-learning-resources/inclusive-teaching/statements\)](https://www.brown.edu/sheridan/teaching-learning-resources/inclusive-teaching/statements)

Student Parents/Guardians/Caregivers

I realize that student parents/guardians and caregivers face distinctive challenges in succeeding academically, and I'm committed to supporting those of you who are parents to achieve our course's learning outcomes. If you encounter challenges in meeting course expectations – for example, fulfilling attendance and participation requirements or submitting assignments due to a child or person in your care's illness, essential appointment, school closure, etc. – please contact me as soon as possible (beforehand if feasible or as soon afterward you reasonably can if not). We'll develop a plan

for you to make up missed work. If you need to bring your child or person you care for to class, for example because you're nursing or planned childcare became unavailable, I encourage you to do so if it's feasible for you to participate in class and support your child or person in your care.

Finally, know that [pregnant and parenting students are guaranteed equal educational opportunities by Title IX](https://www2.ed.gov/about/offices/list/ocr/docs/dcl-know-rights-201306-title-ix.html); know your rights, the protections provided, and how to advocate for yourself.

Student Case Management

[Student case management](https://studentcasemanagement.colostate.edu/) is available to help students with extenuating life circumstances and connect them with resources. In some cases, after you and I discuss your situation, I may request [verifiable documentation for class absences](https://studentcasemanagement.colostate.edu/class-absences/) from the SCM office if you request considerations for absences or missed coursework.

Mental Health and Wellness

CSU Has Resources to Help

Many of us are struggling. 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. 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.






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: <https://health.colostate.edu/mental-health-resources/>

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.

Course Summary:

Date	Details	Due
Fri Jan 21, 2022	 Quiz 1	due by 11:59pm (https://colostate.instructure.com/courses/141764/assignments/1753421)
Wed Jan 26, 2022	 Homework 1	due by 11:59pm (https://colostate.instructure.com/courses/141764/assignments/1729853)
Fri Jan 28, 2022	 Quiz 2	due by 11:59pm (https://colostate.instructure.com/courses/141764/assignments/1753508)
Wed Feb 2, 2022	 Homework 2	due by 11:59pm (https://colostate.instructure.com/courses/141764/assignments/1729854)
Fri Feb 4, 2022	 Quiz 3	due by 11:59pm (https://colostate.instructure.com/courses/141764/assignments/1753530)

Wed Feb 9, 2022	 Homework 3 (https://colostate.instructure.com/courses/141764/assignments/1729855)	due by 11:59pm
Fri Feb 11, 2022	 Quiz 4 (https://colostate.instructure.com/courses/141764/assignments/1753534)	due by 11:59pm
Wed Feb 16, 2022	 Homework 4 (https://colostate.instructure.com/courses/141764/assignments/1729856)	due by 11:59pm
Fri Feb 18, 2022	 Quiz 5 (https://colostate.instructure.com/courses/141764/assignments/1753562)	due by 11:59pm
Wed Feb 23, 2022	 Homework 5 (https://colostate.instructure.com/courses/141764/assignments/1729857)	due by 11:59pm
Fri Feb 25, 2022	 Quiz 6 (https://colostate.instructure.com/courses/141764/assignments/1753563)	due by 11:59pm
Wed Mar 9, 2022	 Homework 6 (https://colostate.instructure.com/courses/141764/assignments/1729858)	due by 11:59pm
Fri Mar 11, 2022	 Quiz 7 (https://colostate.instructure.com/courses/141764/assignments/1753585)	due by 11:59pm
Wed Mar 23, 2022	 Homework 7 (https://colostate.instructure.com/courses/141764/assignments/1729859)	due by 11:59pm
Fri Mar 25, 2022	 Quiz 8 (https://colostate.instructure.com/courses/141764/assignments/1753586)	due by 11:59pm
Fri Apr 1, 2022	 Quiz 9 (https://colostate.instructure.com/courses/141764/assignments/1753588)	due by 11:59pm
Wed Apr 6, 2022	 Homework 8 (https://colostate.instructure.com/courses/141764/assignments/1729860)	due by 11:59pm
Wed Apr 13, 2022	 Homework 9 (https://colostate.instructure.com/courses/141764/assignments/1753936)	due by 11:59pm

Fri Apr 15, 2022

**Quiz 10**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753591>

Wed Apr 20, 2022

**Homework 10**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753938>

Fri Apr 22, 2022

**Quiz 11**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753594>

Wed Apr 27, 2022

**Homework 11**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753939>

Fri Apr 29, 2022

**Quiz 12**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753596>

Wed May 4, 2022

**Homework 12**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753940>

Fri May 6, 2022

**Quiz 13**

due by 11:59pm

<https://colostate.instructure.com/courses/141764/assignments/1753597>