Course Syll

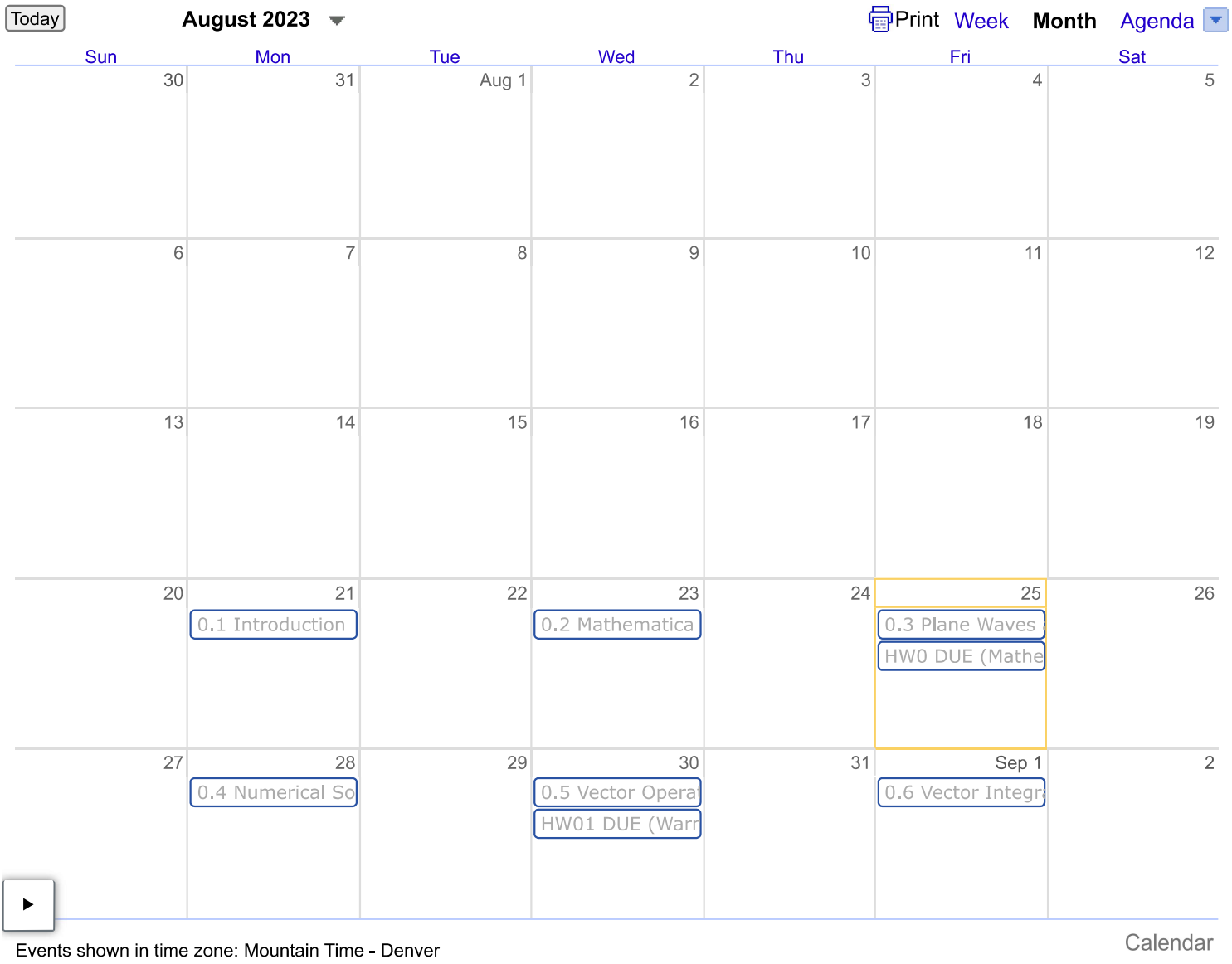
ECE 504 Physical Optics

Classical optics from first principles; basic electromagnetic theory to wave and geometric guides. This course lays a foundation for further study in nonlinear and ultrafast optics, lasers, quantum optics.

Calendar:

Link to Google calendar (https://calendar.google.com/calendar/embed?src=647df0bbfa24903a8c29f1b319a8b1dbea779028590576158 1872ee299ee6b22%40group.calendar.google.cc

ECE504 FA2023



Fall 2023

Lectures: 9:00-9:50 AM MWF, Engineering B105

Instructor: Jesse Wilson

Email: **jesse.wilson@colostate.edu (mailto:jesse.wilson@colostate.edu)**

MS Teams Messaging: jessew@colostate.edu

Phone: 970-491-3706

Office Hours: by appointment

Your feedback and input is always welcome! You can help shape this class for future students.

PREREQUISITES: ECE341, ECE342 or graduate standing

REQUIRED MATERIALS:

Required Software

- Mathematica version 13.3.
  - Available for students to install on their own computers, through CSU's site license. Contact Nic Larrivee for info (**nic.larrivee@colostate.edu (mailto:nic.larrivee@colostate.edu)**).

Required textbooks:

- *Physics of Light and Optics* by Peatross & Ware. Free download from **http://optics.byu.edu/textbook.aspx (http://optics.byu.edu/textbook.aspx)**

Supplemental textbooks:

- *Photonics: An Introduction* by Reider. PDF downloadable through CSU Library subscription from any on-campus computer or through the library proxy: **https://link.springer.com/book/10.1007%2F978-3-319-26076-1 (https://link.springer.com/book/10.1007%2F978-3-319-26076-1)**
- *Introduction to Modern Optics* by Grant R. Fowles. Print version ~$22. **https://store.doverpublications.com/0486659577.html (https://store.doverpublications.com/0486659577.html)**

Canvas: canvas.colostate.edu will have the syllabus, links, homework, course grades and other postings. It is your responsibility to check the calendar under the Index tab each week for new postings.

COURSE TOPICS: The planned topics for this course are broken up into 6 modules, each of which will be followed by an exam

- Intro, Mathematica basics, review vector calc, and Fourier theory, and numerical simulation of PDEs.
- Review of E&M, Maxwell's equations, and deriving the wave equation.
- Plane wave propagation, complex index of refraction, Lorentz model, Kramers-Kronig, Poynting vector, energy flow
- Reflection/transmission through single and multiple interfaces, dielectric coatings (e.g. anti-reflection), evanescent coupling

- Propagation in anisotropic media and birefringence, polarization effects and manipulation
- Ray optics, Eikonal equation, Fermat's principle, ABCD matrices
- Diffraction theory, Huygens' principle, paraxial approximation, Helmholtz equation, Fresnel and Fraunhofer approximations, and scattering.

GRADING:

Reading assignments due before each lecture: 10%

Weekly homework assignments: 40% (the lowest 2 scores will be dropped)

Midterm Exams: 40% (the lowest 1 score will be dropped)

Comprehensive Final Exam (Wednesday Dec 13th 4:10-6:10PM): 10%

Online 801 Section: Exams will be handled as Canvas Quizzes with a time limit equal to that available for in-person (001 Section). These Quizzes will be available starting 12:00AM and ending 11:59PM on the scheduled day of the exams.

Final grades will be determined by the following scale:

Name:	**Range:**	
A+	100 %	to 96.67%
A	< 96.67 %	to 93.33%
A-	< 93.33 %	to 90.0%
B+	< 90.0 %	to 86.67%
B	< 86.67 %	to 83.33%
B-	< 83.33 %	to 80.0%
C+	< 80.0 %	to 76.67%
C	< 76.67 %	to 70.0%
D	< 70.0 %	to 60.0%
F	< 60.0 %	to 0.0%

HOMEWORK:

Weekly homework will due typically on Wednesdays. Each problem should be explained conceptually for full credit.

Links to the homework can be found on Canvas. I request that you record the time spent on each question on your paper. **All late assignments will receive a zero.**

Unless otherwise indicated, all homeworks for this class are to be submitted as Mathematica notebooks.

All submitted homework and code must be your own individual work. Since a large portion of the work will be writing Mathematica code, students are expected to adhere to the Academic Integrity Policies found on the Computer Science Department website: **http://www.cs.colostate.edu/cstop/csacademics/student_info.php (http://www.cs.colostate.edu/cstop/csacademics/student_info.php)** . Cases of plagiarism will receive a negative grade.

ACADEMIC INTEGRITY: Students are expected to adhere to the Academic Integrity Policy of Colorado State University, outlined in the CSU General Catalog. Students are also expected to follow the Student Conduct Code which can be found at www.conflictresolution.colostate.edu. **Academic dishonesty is not accepted in this course, and any form of cheating (including plagiarism, *even if unintentional*) will result in a negative grade for the assignment.** Penalties may include reporting to the University, loss of course credit, and expulsion from the university.

If you have any doubts about what constitutes plagiarism, please read here:

https://writingcenter.unc.edu/tips-and-tools/plagiarism/ (https://writingcenter.unc.edu/tips-and-tools/plagiarism/)

ARTIFICIAL INTELLIGENCE / CHATBOT ASSISTANCE: Students are welcome to use ChatGPT or other AI tools to generate starter code for the homework assignments, under the following conditions: (1) automatically-generated text for written portion of assignments is not allowed and (2) all AI-generated code should be marked clearly, (3) the prompt used to generate the code must also be documented in the assignment, and (4) debugging and modification process should be documented, e.g. did the code work right away? Did it need to be corrected? What was done to validate the results and make sure it's working as intended?

Course Summary:

Date	Details	Due
Fri Aug 25, 2023	**Reading for Lecture 0.3** (https://colostate.instructure.com/courses/172531/assignments/2209588)	due by 8:50am
	HW00: Mathematica Tutorial (https://colostate.instructure.com/courses/172531/assignments/2148099)	due by 11:59pm
Mon Aug 28, 2023	**Reading for Lecture 0.4** (https://colostate.instructure.com/courses/172531/assignments/2211150)	due by 8:50am