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=4hr45hvd8tpi8tfa5g78li1mf4%40group.calendar.google.com&ctz=America%2FDenver)

ECE504 FA2021

Today **October 2021** Print Week **Month** Agenda

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27 2.1 Differential a	28	29 2.2 Dipoles and r	30 HW05 Gauss' Law	Oct 1 2.3 Lorentz mode PROJECT PROPOS	2
3	4 2.4 Kramers-Kror	5	6 2.5 Drude Model	7 HW06 Magnetic F	8 2.6 Poynting, par	9
10	11 2.7 Poynting part	12	13 REVIEW	14 HW07 Lorentz/Kr	15 EXAM 3 Plane wa	16
17	18 3.1 Snell's law	19	20 3.2 Fresnel coeffi	21 HW08 Poynting D	22 3.3 Double interfa	23
24	25 3.4 Multilayer sta	26	27 REVIEW	28 HW09 Total Inter	29 EXAM 4 Interface	30
31	Nov 1 4.1 Anisotropy in	2	3 4.2 Susceptibility	4 HW10 Multilayer	5 4.3 Index Ellipsoi PROJECT PROGRE	6

Events shown in time zone: Mountain Time - Denver

Calendar

Fall 2021

Lectures: 10:00-10:50 AM MWF, Forestry 217

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:

In lieu of purchasing a textbook, this course has a software requirement:

- Mathematica Student Desktop software (version 11 or higher).
  - 1-semester license available for $54. **https://www.wolfram.com/mathematica/pricing/students-individuals.php (https://www.wolfram.com/mathematica/pricing/students-individuals.php)** .

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)**
- *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)**

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, scattering

GRADING:

Participation (reviewing your peers' assignments): 10%

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

Exams: 25% (the lowest 1 score will be dropped)

Final project/presentation: 25%

The final projects presentation date and location is TBD. Check with your instructor and Canvas for updates.

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 be assigned Thursday or Friday and due at the end of the day the following Thursday. Each problem should be explained conceptually for full credit.

Peer grading: you will be assigned (randomly) a classmate's assignment to grade by the Friday after the assignment deadline. Full credit given for accurate scoring in the grading rubric, leaving thoughtful comments, and reflecting on what you learned. Final grades will be determined by the instructor.

Privacy: **do not include your student ID number or any sensitive information on your assignments**. You may opt to leave out your name on the assignment, if wish your assignment to be anonymous when graded by your peers.

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/)

Course Summary:

Date	Details	Due
Thu Aug 26, 2021	HW00: Mathematica Tutorial (https://colostate.instructure.com/courses/126942/assignments/1635250)	due by 11:59pm
Thu Sep 2, 2021	HW01: Warmup (https://colostate.instructure.com/courses/126942/assignments/1630912)	due by 11:59pm
Fri Sep 3, 2021	HW01 Peer review (https://colostate.instructure.com/courses/126942/assignments/1633552)	due by 11:59pm
Thu Sep 9, 2021	HW02: Fourier Transforms (https://colostate.instructure.com/courses/126942/assignments/1630525)	due by 11:59pm
Fri Sep 10, 2021	HW02 Peer review (https://colostate.instructure.com/courses/126942/assignments/1640844)	due by 11:59pm