PHYS 153: Physics of Light, Color, and Vision (CRN: 35123) Spring Term 2020
Syllabus
(updated 31 March 2020, subject to change)

Instructor: Brian Smith
Office: Zoom
Phone: +1 541 346 5790
Email: bjsmith@uoregon.edu
Office hours: TBD

Teaching Assistants

<table>
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<tr>
<th>Layne Bradshaw, <a href="mailto:layneb@uoregon.edu">layneb@uoregon.edu</a></th>
<th>Sean Brudney, <a href="mailto:sbrudney@uoregon.edu">sbrudney@uoregon.edu</a></th>
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<td>Office: TBD</td>
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<td>Tu/Th Groups: TBD</td>
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<td>Justin Kittell, <a href="mailto:jkittell@uoregon.edu">jkittell@uoregon.edu</a></td>
<td>David Miller, <a href="mailto:dmiller3@uoregon.edu">dmiller3@uoregon.edu</a></td>
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Meeting times and location

Lectures: Recorded online – accessible via Canvas
Tutorial sessions: Tu and Th 10:00-11:50 via Zoom - Time depends upon your group (TBD)
Credits: 4

Communication: The best form of communication between students and the teaching team will be via email. You must use your uoregon.edu email address. Use PHYS 153 in the subject line. Email will be checked only during normal work hours (M-F 8am-6pm).

Course Synopsis: Light has a profound impact on our daily lives both directly and indirectly. This course will explore the physics of light and explain how its basic properties produce a diverse range of effects in technology and nature. The course is concept driven and requires a minimum of mathematics (algebra – we will cover a bit of trigonometry at the end – though it is not crucial).

The course will begin with an introduction to science and how scientists think and view the world. We will then have a basic introduction to waves. Then we move to the description of light as an electromagnetic wave. Light is part of a larger family of the electromagnetic spectrum, which spans through gamma rays, X-rays, ultraviolet radiation, light, infra-red radiation, microwaves and radio waves. The manner in which these various forms of radiation interact with the world will be compared and contrasted. This leads to the discussion of color and how different objects display different colors. Two key properties of light – reflection and refraction of light – are then discussed. We show how these are used to create images and how mirrors and lenses can be used to magnify objects. This leads us to human vision and a (physicist’s) description of the eye, common vision errors and ways we correct these (e.g. glasses). Time permitting we will cover light polarization and the wave properties of light – particularly diffraction and interference.
**Course learning objectives:** By the end of this course students should be able to:

1. Describe the physical basis for light and its properties
2. Discuss how the physical properties of light result in different phenomena observed in nature and technology
3. Explain how color arises from objects
4. Describe vision and how we perceive an image

**Course resources**

**Course websites:**

*Canvas* will be used in this course as an online resource for the syllabus, course materials, assignments, quizzes and exams. Please frequently check Canvas to stay up to date on the course materials that are posted. Important announcements will also be sent via email, so it is best to get into the habit of checking your email daily.

*Mastering Physics* provides access to the textbook (see below) as well as homework assignments. You will need to register and purchase an access key from the Duck Store (or online at the Mastering Physics website). The course code is PHYS153SPRING2020. I will post instructions how to register for Mastering Physics and the course on Canvas.

**Textbook:** We will utilize *Conceptual Physics* by Paul Hewitt (Pearson) as the main resource for the course, available through the Duck Store. The textbook provides access to the publisher’s Mastering Physics website.

**Course assessment:** Assessment of student learning will be based on participation (reading and going through online lectures with “quizzes”), homework assignments, and two exams. The relative weights will be as follows:

- Participation (20%) Quizzes in lectures are marked only for completion
- Homework assignments (30%) Assigned Thurs. and due following Thurs.
- Exams (50%) Thursday Week 5 and 10 (30 April and 4 June)

**Grading Scale:** The expected grading scale for this course is

- 100-90 = A, 90-80 = B, 80-70 = C, 70-60 = D, <60 F.

If necessary, a curve may be applied to achieve a higher average final grade. However, you are guaranteed at least the grade listed here based on your course average. Pass/fail grading option: A passing grade requires at least the equivalent of a C- grade.

**Expectations**

**Learning activities:** Learning is an active process and the classroom, laboratory, and office meetings should be places to exchange ideas.

The main learning activities for this course will be

1. Reading through the textbook
2. Listening to recorded lectures and answering quiz questions
3. Homework sets
4. Participation in office hours and tutorial sessions (optional)
5. Exams will test your knowledge
If you have questions or are unsure of material, you should seek assistance by sending an email to the instruction team. It is your responsibility to ask questions and seek clarification, direction and guidance to any assignments – we do not know what you do not ask.

**Note:** There will be an exam during Dead Week and no examination during finals week.

**Course reading:** Reading from *Conceptual Physics* by Paul Hewitt are given in the course schedule below.

**Course feedback:** If you have suggestions for improving anything about how the course is going, please drop the instructor a note.

**Academic honesty:** Students have the responsibility to behave honorably in an academic environment. The University Student Conduct Code ([http://dos.uoregon.edu/conduct](http://dos.uoregon.edu/conduct)) defines academic misconduct. Academic dishonesty, including cheating, fabrication, facilitating academic dishonesty, and plagiarism, devalues the reputation of our institution, its faculty, its students, and the degrees we offer. Moreover, academic misconduct is particularly unfair for the students who do their work with integrity and honor. All incidences of suspected academic misconduct will be reported to the Office of Student Conduct and Community Standards. The procedures for handling academic misconduct cases are outlined in Oregon Administrative Rule OAR517-021-0215.

**Creating an inclusive learning environment:** Students are expected to conduct themselves in a manner that contributes to a positive learning environment for all in the course.

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**Accessible Education:** *The University of Oregon is working to create inclusive learning environments. Please notify us if aspects of the instruction or course design result in barriers to your participation. You are also encouraged to contact Accessible Education Center in 164 Oregon Hall at 346-1155.*

If you have a documented need for accommodations in this course, please arrange to meet with the instructor in the first week of term so that we can design a plan for you. Also please request that the Accessible Education Center (AEC) send a letter verifying your documented needs for accommodations. [http://aec.uoregon.edu](http://aec.uoregon.edu) If you have a disability, but have not registered with AEC, you should contact them as soon as possible. It is more likely that adequate special accommodation can be made if organized through AEC.
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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture</th>
<th>Assignment / Exam</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1</td>
<td>31-Mar-20</td>
<td>Intro and housekeeping, Science as a human activity, physics, and optics (study of light), mathematics, measurements, precision, accuracy. Waves</td>
<td></td>
<td>Ch. 1,19</td>
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<td>2</td>
<td>7-Apr-20</td>
<td>Light properties: EM waves, velocity, spectrum (frequency and wavelength)</td>
<td>Assignment 1 (Ch. 1, 19)</td>
<td>Ch. 26</td>
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<td>3</td>
<td>14-Apr-20</td>
<td>Light properties: Light matter interaction, absorption / resonance, transparent and opaque materials, dispersion, Color, scattering</td>
<td>Assignment 2 (Ch. 26)</td>
<td>Ch. 26, 27</td>
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<td>4</td>
<td>21-Apr-20</td>
<td>Color, scattering, reflection</td>
<td>Assignment 3 (Ch. 27)</td>
<td>Ch. 27, 28</td>
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<td>5</td>
<td>28-Apr-20</td>
<td>Reflection and refraction</td>
<td>Exam 1 (Ch 1, 19, 26, 27)</td>
<td>Ch. 28</td>
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<td>6</td>
<td>5-May-20</td>
<td>Reflection and refraction, dispersion (prisms and rainbows)</td>
<td>Assignment 4 (Ch. 28)</td>
<td>Ch. 28</td>
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<tr>
<td>7</td>
<td>12-May-20</td>
<td>Lenses and imaging, vision</td>
<td>Assignment 5 (Ch. 28)</td>
<td>Ch. 28</td>
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<td>8</td>
<td>19-May-20</td>
<td>Lens errors and vision errors, Light waves</td>
<td>Assignment 6 (Vision)</td>
<td>Ch. 26/28/notes</td>
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<td>9</td>
<td>26-May-20</td>
<td>Light waves</td>
<td>Assignment 7 (Ch. 29)</td>
<td>Ch. 29</td>
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<td>10</td>
<td>2-Jun-20</td>
<td>Light waves</td>
<td>Exam 2 (Ch. 28-29)</td>
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Other important dates:
Last day to drop without W: 4 April 2020
Last day to register: 6 April 2020
Last day to withdraw: 17 May 2020