

# **OPTI 100H: What is Light?**

## **Course Goal**

Introduce you to the fascinating field of optics and how it so important in our daily lives, how it leads to new technologies, learn about the broad and extensive careers, and how to explain and analyze light.

## **Pre-requisites**

None

## **Overview**

Light is an important aspect of our daily lives, from the lights that we use to see, to the displays that give us information and entertainment, to lasers that are used on optical fibers to transfer information from one place to another. This course will delve into what light is by presenting the technology, phenomena, and systems that we use on daily basis. It starts with our eyes used to view our smartphone or computer displays. The information for these displays is provided via networks, which in the long haul sector use fiber optics, lasers, and other optical subsystems. Along the way we will discuss the three interpretations of light: as a ray (geometrical), as a wave (physical), and as both known as the wave-particle duality (quantum).

## **Number of Units/component**

The class is three units and comprised of lecture (50% workload); and discussions, tours, and labs (50%).

## **Locations and Times:**

TR 2.00 pm – 3.15 pm Meinel 432

## **Instructor Information**

John Koshel: 403A, Academic Programs office, 621-6357

Open / by appointment (most individuals in the AP Office can access my schedule)

- Available via Zoom at <https://arizona.zoom.us/my/koshel>
- I get an email when you enter – wait a couple minutes to see if I can get into Zoom
- If not, I will email you back about availability (you must have your name / recognizing ID within Zoom)

## **Expected Learning Outcomes**

1. Demonstrate an understanding of how light through technology, phenomena, and systems are a part of our daily lives, which is done through discussion, laboratories, problem solving, & so forth (Student Outcome 2).
2. Demonstrate an understanding of the three interpretations of light (geometrical, physical, and quantum) through discussion, solving problems, and so forth (Student Outcome 1).
3. Conduct simple experiments to be able to manipulate, measure, and use light (Student Outcome 3).
4. Learn technical communication via papers, videos, and presentation on student selected topics (Student Outcome 6).

## **Required Texts**

Required: none; course notes will be provided

Recommended: SPIE Field Guides (see <http://spie.org/publications/books/field-guides>; free e-books online)

## **Topics and/or general calendar**

Week 1: Introduction to light: description, properties, ...

Field Trip: optics in nature around us

Lab/discussion: optics around us, in particular sources and spectrum

### **LIGHT IS A RAY**

Week 2: Start the light journey – looking at your Smartphone, computer, tablet – Intro to the human eye

Field Trip: vision lab

Lab/discussion: the components of the eye

Week 3: Smartphones – follow the rays (geometrical optics) back into the phone

Field Trip: Displays labs

Lab/discussion: components of displays

Week 4: Smartphones – the other optical systems in your phone

Field Trip: building tour – optics museum

Lab/discussion: look into a cell phone

Week 5: Light as a ray – how do we design these optical systems?

Field Trip: Optical design labs

Lab/discussion: Intro to software

Week 6: The nitty gritty of optical design

Field Trip: maybe a trip to a local software company

Lab/discussion: use of design software

Week 7: Forming the image – detectors

Field Trip: Imaging Labs

Lab/discussion: teaching labs – working with detectors

### **LIGHT IS A WAVE**

Week 8: Lasers – sources powering the internet

Field Trip: Laser Labs

Lab/discussion: looking at the properties of a laser, total internal reflection

Week 9: The internet is made up by optical fibers

Field trip: TOAN labs

Lab/discussion: coupling into a fiber

Week 10: Optical switches, steering light

Field Trip: polarization or design labs

Lab/discussion: polarization or DMD “switch”

Week 11: Interference and diffraction

Field Trip: interferometer lab or visit to local industry

Lab/discussion: interferometer setup

Week 12: Optics is more than the telecom components...

Field Trip: Lithography labs

Lab/discussion: state-of-the art systems

## **LIGHT IS BOTH**

Week 13: Quantum optics

Field Trip: BEC labs

Lab/discussion: what does all of this mean...

Week 14: Quantum Information/Engineering

Field Trip: QE labs

Lab/discussion: continue discussion

Week 15: Course wrap up and presentations

Field Trip: Mirror lab (optional)

NOTE: this schedule is approximate. Tours and the like depend on lab availability, so the schedule will be updated to accommodate if and when we can get to a certain lab.

## **Major Course Assignments**

- No exams
- One short paper in each section
- One course paper and presentation
- Video presentation(s)

## **Course Policies**

### **Grading Policy**

All handed-in materials are due in D2L by 11.59 pm on the stated dates

Video Presentation(s)	10%	4-5 minute video(s)	Friday, 9 February
Light is a Ray paper	10%	3+ page paper	Friday, 23 February
Light is a Wave paper	10%	3+ page paper	Friday, 22 March
Light is Both paper	10%	3+ page paper	Friday, 19 April
Course Presentation and Paper	30%	10 minutes/6+ pages	30 April / 3 May
Assignments	20%		1 week following
Discussion Board/Class Participation	10%		throughout course
Total	100%		

The grade will be determined according to the cumulative percentage earned such that 90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, below 60% = E.

## **University-Wide Policies**

Links to the following UA policies are provided here, <http://catalog.arizona.edu/syllabus-policies>:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement

## **Other policies**

- Confidentiality: <http://www.registrar.arizona.edu/ferpa>
- Safety: For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): <https://cirt.arizona.edu/case-emergency/overview>
- Safety video:  
[https://arizona.sabacloud.com/Saba/Web\\_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560](https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560)
- Classroom Behavior: To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

## **Additional resources**

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

### **Campus Health**

<http://www.health.arizona.edu/>

Campus Health provides quality medical and mental health care services through virtual and in-person care.

Phone: 520-621-9202

### **Counseling and Psych Services (CAPS)**

<https://health.arizona.edu/counseling-psych-services>

CAPS provides mental health care, including short-term counseling services.

Phone: 520-621-3334

### **The Dean of Students Office's Student Assistance Program**

<https://deanofstudents.arizona.edu/support/student-assistance>

Student Assistance helps students manage crises, life traumas, and other barriers that impede success. The staff addresses the needs of students who experience issues related to social adjustment, academic challenges, psychological health, physical health, victimization, and relationship issues, through a variety of interventions, referrals, and follow up services.

Email: [DOS-deanofstudents@arizona.edu](mailto:DOS-deanofstudents@arizona.edu)

Phone: 520-621-7057

### **Survivor Advocacy Program**

<https://survivoradvocacy.arizona.edu/>

The Survivor Advocacy Program provides confidential support and advocacy services to student survivors of sexual and gender-based violence. The Program can also advise students about relevant non-UA resources available within the local community for support.

Email: [survivoradvocacy@arizona.edu](mailto:survivoradvocacy@arizona.edu)

Phone: 520-621-5767