OPTI 205: Optics of Photography and Videography
(Effective Spring 2017)
Locations and Times: TBD

Description of Course
Students completing this course will gain an understanding of the optical principles and sensor technologies that are employed in modern digital cameras, cell phones, and video cameras. They will have been exposed to the history of camera and lens development, and develop an appreciation for how choices of lens, aperture, exposure, and related settings affect the visual impact of the images that are captured. They will have learned the basics of post-acquisition processing software and have an understanding of display technologies ranging from projection to print.

Course Prerequisites or Co-requisites
Students should have completed a course in college algebra and trigonometry

Instructor and Contact Information
Prof. Lars R. Furenlid
626-4256
furen@radiology.arizona.edu

Course Format and Teaching Methods
Lecture only (3 units)

Course Objectives and Expected Learning Outcomes
i) Students will be able to perform technical analysis of photographic imagery, ie be able to deduce estimated camera settings used in several well-known photographs.

ii) Students will be able to describe the evolution of camera lens designs from early simple glass elements through modern multi-element optics with coatings and aberration corrections.

iii) Students will be able to discuss the relative strengths and weaknesses of photographic sensors for different applications – specifically film, CCD, and CMOS.

Absence and Class Participation Policy
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Required Texts or Readings
Required or Special Materials
None

Required Extracurricular Activities (if any)
Some homework assignments will require visits to the Center for Creative Photography in order to view or work with prints and/or classic camera equipment.

Assignments and Examinations: Schedule/Due Dates
One (1) Midterm Exam
One (1) Final Exam
Eight (8) Homework Assignments

Final Examination or Project
The date and time of the final exam will be posted on the Final Exam Schedule at: http://www.registrar.arizona.edu/schedules/finals.htm

Grading Scale and Policies

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm exam</td>
<td>33.3%</td>
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<tr>
<td>Final Exam</td>
<td>33.3%</td>
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<tr>
<td>Homework (8 assignments total)</td>
<td>33.4%</td>
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<tr>
<td>Total</td>
<td>100%</td>
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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.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Scheduled Topics/Activities
- Physical principles of image formation and light
  - Absorption
  - Refraction
  - Reflection
  - Spectral properties
  - Polarization

- Camera lenses
  - Pinholes
  - Simple lenses
  - Telephoto, wide angle, fisheyes, and zooms
  - Fresnel lenses
  - Reflective optics
  - Cell-phone optics
  - Macro and astro

- Sensors
  - Emulsions from Daguerrotype to Kodachrome to Polaroid
  - CCDs
- CMOS
- Color versus B&W
- ISO, sensitivity and dynamic range

- Filters
  - Neutral and graduated density
  - Polarizers
  - UV/haze
  - Special effects

- Aberrations, calibration, and testing
  - Diffraction
  - Third order/Seidel aberrations
  - Chromatic aberration
  - Focus and color calibration
  - Resolution test patterns

- Modern Cameras
  - SLRs, mirrorless, medium format
  - Manual and autofocus
  - Manual and autoexposure
  - Vibration reduction
  - Photography’s “Rules of thumb”

- Image properties
  - The 35mm standard
  - Focal length and scene compression/expansion
  - Depth of field, blur and Bokeh
  - Color fidelity, color perception, and human vision
  - Contrast, resolution, and dynamic range

- Specialty imaging
  - High dynamic range
  - Slow-motion and time-lapse
  - Stereo/3D
  - Light-field
  - IR, UV, and polarized
  - Special lighting – strobes – multi-camera setups
  - Drones, gimbals, and action cams
  - Panoramas
  - Documentary, scientific, architectural, landscape, wildlife, and portraiture

- Analog and digital developing/processing and displays
  - Enlargers and film printing
  - Digital image processing software
  - Basics of video editing software
  - Image/video file formats and compression
  - Lens distortion and color correction
  - Panoramic stitching
  - Additive and subtractive color, RGB and CMY
  - Monitors – LCD, OLED, Plasma
  - Projectors – LCD, LCOS, DMM, LASER

- History of photography
  - Icons of camera development
Classroom Behavior Policy
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.).

Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations
Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit http://drc.arizona.edu.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://www.library.arizona.edu/help/tutorials/plagiarism/index.html.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor’s express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.