

OPTI 205, Optics of Photography and Videography Syllabus, Spring 2023

This course presents the optical principles and sensor technologies that are employed in modern digital cameras, cell phone cameras, and video cameras. Lectures are designed to impart a sense of the history of camera and lens development and an understanding of how choices of lens, aperture, exposure, and related settings affect the visual impact of images that are captured. Special hands-on assignments with DSLRs and post-acquisition processing encourage the development of technical skills. Students are introduced to the Center for Creative Photography and the works in their collections.

Lectures and assignments during the semester will consider the following topics:

- Physical principles of light and image formation, including absorption, refraction, reflection, spectral properties, and polarization
- Camera lenses, including pinholes, ideal thin lenses, telephoto, wide angle, fisheyes, and zooms, Fresnel lenses, reflective optics, cell-phone optics, macro and micro
- Imaging sensors, including emulsions from silver salt to Daguerrotypes to Kodachrome to Polaroid, CCDs, CMOS, color versus B&W, ISO, sensitivity and dynamic range
- Filters, including neutral and graduated density, polarizers, UV/haze, special effects
- Aberrations, calibration, and testing, including diffraction, third order/Seidel aberrations, chromatic aberration, focus and color calibration, resolution test patterns
- Modern cameras, including SLRs, mirrorless, medium format, manual and autofocus, manual and autoexposure, vibration reduction, photography's "Rules of thumb"
- Image properties, including 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, including 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, including 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, including inventors: Talbot, Daguerre, ... icons of camera development: Leitz, Zeiss, Hasselblad, Eastman, Land, ... and great photographers: Brady, Stieglitz, Weston, Lange, Adams, Winograd, ...

Learning objectives:

Upon completion of this course, students will

- be able to identify all of the components a modern DSLR/Mirrorless camera and be able to adjust all of the controls to achieve desired image characteristics;
- be able to assess cameras and lenses for optical performance and build quality; and
- be able to perform technical analyses on photographic images, deducing lens focal lengths, aperture settings, lighting, where focus was set, and major elements of composition.