Physics 325 - Optics

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Office Hours: See information on-line at http://www.mnstate.edu/lindaas

Official Course Description:
This course covers geometrical and physical optics including paraxial theory, interference, diffraction, polarization and optical instruments.

Prerequisites:
This course builds on concepts introduced in general physics 2 (PHYSICS 201) and will utilize ideas and techniques from calculus.

Required Materials:

- **Optics for Dummies**, by Galen C. Duree Jr., Wiley (2011) **ISBN-13:** 978-1118017234
- **Physics of Light and Optics**, by Justin Peatross and Michael Ware, BYU (2015) [PDF] http://optics.byu.edu/textbook.aspx
- **University Physics Volume 3** (*Unit 1*)**,** by S. Lind, J. Sanny and B. Moebs, OpenStax (2016) [PDF]
- Access to mathematical modeling tools: Python and Maple (or Mathematica)

Supplemental Materials:

- **Optics 4th Edition**, by Eugene Hecht, Pearson (2002) ISBN 0-8053-8566-5
- **Introduction to Optics 3rd Edition**, by F.L. Pedrotti S.J., L.M. Pedrotti and L.S. Pedrotti, Prentice Hall (1998) ISBN-13: 978-0131499331

Course Objectives / Student Learning Outcomes:
This is an applied optics and image-processing course. The goal is to be able to understand the physics of various imaging techniques as well as methods to extract information from images. The foundation will begin by covering waves in general and light (electromagnetic waves) in particular. This will lead to understanding geometric optics; including image formation, aberrations and optical systems involving multiple surfaces. From geometric optics we will move to physical optics starting with polarization and interference effects. We will then cover both Fresnel and Fraunhofer diffraction. We will then move to basic aspects of signal processing including convolution, correlation, filtering and Fourier transforms. Over the course of the semester our discussions will be grounded in real applications. The goal is to cover various imaging techniques such as optical microscopy (Nomarski and confocal), astronomy, electron microscopy, x-ray microscopy, scanning probe microscopy, magnetic resonance imaging, holography and tomography.

Evaluation:
Each component of the course has the following weight. Note: If you believe this rubric does not reflect your strengths then you may propose a modification.

Homework		Exams	
Problems	Analysis Reports	Tests and Quizzes	Final
30%	30%	30%	10%

Grades will be assigned on the absolute scale below; plusses and minuses will be used for the top or bottom quarter of a bracket.

A	B	C	D	F
100-90%	89-80%	79-70%	69-60%	< 60%

- **Homework:** There will be roughly one problem set every week. Reading response forms will count toward homework. No late work will be accepted. However you may propose optics related activities to (partially) replace a missed homework.
- **Lab Activities:** There will be roughly six lab activities assigned to highlight significant optical techniques.
- **Analysis Reports:** You will research a variety of topics during the semester. You will create a written report as well as a verbal summary for your peers. The reports will be on:
  - Historical person or event
  - Optical phenomena
  - Optical instrumentation
  - Optical experiment or technique (lab activity)

  You are encouraged to propose a topic that interests you.
- **Participation:** You will be responsible for leading the discussion and problem solving for sections and associated problems on a rotating basis. In particular you are responsible for resolving your peers' questions. You will be expected to constructively participate in your peers' discussions including articulating questions.
- **Quizzes:** Short homework quizzes may be given periodically.
- **Exams:** There will be approximately three tests and a cumulative final exam. No late exams will be given.
- **Universal Excuse Form:** Sometimes life happens. The purpose of the Universal Excuse Form (UEF) is to allow you to take responsibility for your education. Use an UEF if you want to:
  - turn in late homework or labs
  - arrange alternative test dates – preferably in advance!
  - petition to make up missed quizzes or exams
- **Academic Honesty:** Your education is only as good as your integrity. If you have any questions as to what is acceptable behavior see the instructor or review the MSUM Student Academic Policy in the Student Handbook: https://www.mnstate.edu/student-handbook/ (under Student Policy Info).

Class Schedule:

Lecture: Tuesday and Thursday	12:00 – 1:15 pm	Hagen 305

Course Web Site:

http://web.mnstate.edu/lindaas/ and Desire to Learn (D2L)

This course makes extensive use of the internet to distribute course materials (homework, solutions, etc.). If you anticipate having difficulty accessing the internet, please see Dr. Lindaas as soon as possible.

Special Accommodations:
Minnesota State University Moorhead is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you may have, a disability (e.g. mental health, attentional, learning, chronic health, sensory or physical) please contact the DRC at (218) 477-4318 (V) or (800)627.3529 or 711 (MRS/TTY) to schedule an appointment for an intake.
- Additional information is available on the DRC website: http://www.mnstate.edu/disability/
- If you are registered with the DRC and have a current Accommodation Letter, please schedule an appointment to visit with me, during my office hours, to discuss implementation of your accommodations.

Sexual Violence:
Acts of sexual violence are intolerable. MSUM expects all members of the campus community to act in a manner that does not infringe on the rights of others. We are committed to eliminating all acts of sexual violence.

MSUM faculty and staff are concerned about the well-being and development of our students. We are obligated to share information with the MSUM Title IX Coordinator in certain situations to help ensure that the students' safety and welfare is being addressed, consistent with the requirements of the law. These disclosures include but are not limited to reports of sexual assault, relationship violence, and stalking.

If you have experienced or know someone who has experienced sexual violence, services and resources are available. You may also choose to file a report. For further information, contact Lynn Peterson, Coordinator of Sexual Assault Services at Hendrix Clinic and Counseling Center, 218-477-2211, or Ashley Atteberry, Title IX Coordinator in Owens Hall 208 (218-477-2174; ashley.atteberry@mnstate.edu). Additional information is available at: www.mnstate.edu/titleix