Regardless of course type; e.g., traditional, media-enhanced, or Web, syllabi at UCF are required to include:

- **Course title and number**
- **Credit hours**
- **Name(s) of instructor(s)**
- **Office location**
- **Office or Web hours**
- **Course goals**
- **Course description**
- **Course requirements**
- **Methods of evaluation; grading system, including plus and minus grade policy, how grades will be posted**
- **Makeup exam policy**
- **Required and optional texts**
- **Final exam date and time**
- **Financial Aid Statement**
- **Other required course material**

PRIOR TO PRINTING, DELETE THIS LINE AND ABOVE
ALTER THE SYLLABUS BELOW TO YOUR LIKING

UCF CREOL, THE COLLEGE OF OPTICS AND PHOTONICS

Course Syllabus

OSE6265 Optical Systems Design, 3 Credit Hours

Instructor: Shuo Pang
Email: pang@creol.ucf.edu
Phone:
Office: 407-823-6869

Office Hours: Tuesday 15:00-16:00

Term: 2020 Summer
Class Meeting Days: MoWe
Class Meeting Time: 10:00-11:45
Class Location CROL A214
Website:

Additional Notes: I will be in my office during office hours, but of course I will be happy to discuss the material with you anytime. Please send me an email if you would like to schedule a meeting.

Course Catalog Description:
Design principles of lens and mirror optical systems; evaluation of designs using computer techniques.
Prerequisites:
OSE 5203 Geometric Optics;

Detailed Course Description and Learning Outcomes:

Detailed Description:

This course is designed to provide a comprehensive foundation in design principles of optical systems, as well as the evaluation and optimization of designs using computer techniques. The lectures include an introduction to optical systems design, an introduction to the Zemax optical design software package, paraxial layout, raytracing, stops and pupils, lens design methods, optimization, achromatization, optical aberrations, and image quality metrics. Various classic lenses and optical systems will be studied using the theoretical and computer skills learned in class. Students will learn 1st and 3rd-order calculations, optical design code skills including optimization and image analysis, and optical design philosophy and practical skills.

Learning Outcomes:

Upon completing this course, the students will:

- Evaluate the performance for imaging optical system based on aberration theory.
- Understand the major design constraints in manufacturing and properties in optical materials.
- Understand with common lens-based imaging instruments and design criteria.
- Design basic imaging optical systems using commercially available software (Zemax).

Topics: (A detailed schedule with dates follows at the end of this document.)

- Analysis of optical systems consisting of lenses, mirrors, and apertures.
- Image plane, principal planes, and entrance and exit pupils. Magnification, field of view, F number, image-plane irradiance.
- Ray tracing invariants. Ray tracing using a spread sheet and optical design software.
- Wave front aberration and assessment of image quality resulting from diffraction. Seidel's 3rd order aberration and chromatic aberrations.

Relationship of Course to ABET Criteria

Textbook:

Introduction to Lens Design: With Practical Zemax Examples, Willmann-Bell, 2002

Recommended Reference:

Geometrical Optics and Optical Design, Mouroulis and Macdonald*,* Oxford University Press
Practical Computer-aided Lens Design, Gregory H. Smith, William-Bell, Inc. (1998)
Modern Lens Design, Warren J. Smith, McGraw Hill (1992)
Elements of Modern Optical Design, Donald C. O'Shea, Wiley Series of Pure and Applied Optics
Handbook of Lens Design, Malacara and Malacara, Marcel Dekker, Inc. (1994)

Other Reference Books:

Course Grading and Requirements for Success:

Homework: 5 problem sets.
Exams: Midterm exam on lens design
Quizzes: 5-6 quizzes
Participation:
Final Exam:
Make up Exam Policy: If an emergency arises and a student cannot submit assigned work on or before the scheduled due date or cannot take an exam on the scheduled date, the student **must** give notification to the instructor **no less than 24 hours before** the scheduled date and **no more than 48 hours after the** scheduled
Attendance:

Criteria	Grade Weighting
Homework	50%
Quizzes and participation	10%
Midterm project	20%
Final project	20%
Total	100%

Final Exam Date:

Financial Aid and Attendance: As of Fall 2018, all faculty members are required to document students' academic activity at the beginning of each course. In order to document that you began this course, please complete the following academic activity by the end of the first week of classes, or as soon as possible after adding the course, but no later than August 27. Failure to do so will result in a delay in the disbursement of your financial aid.

Grading Scale (%)	Rubric Description
100 ≥ A > 85	Excellent, has a strong understanding of all concepts and is able to apply the concepts in all and novel situations. Has full mastery of the content of the course.
85 > B ≥ 75	Good, has a strong understanding of most or all of the concepts and is able to apply them to stated and defined situations.
75 > C ≥ 65	Average, has a basic understanding of the major concepts of the course and is able to apply to basic situations.
65 > D ≥ 60	Below average, has a basic understanding of only the simple concepts and is able to apply to only a limited number of the most basic situations.
60 > F ≥ 0	Demonstrates no understanding of the course content.

Grade Objections:
All objections to grades should be made **in writing within one week** of the work in question. Objections made after this period has elapsed will **not** be considered – NO EXCEPTIONS.

Class Website:
Materials used for classes will be available on UCF Webcourses for download before each class. I

Professionalism and Ethics:
Per university policy and plain classroom etiquette, mobile phones, etc. must be silenced during all classroom lectures, unless you are specifically asked to make use of such devices for certain activities. Academic dishonesty in any form will not be tolerated! If you are uncertain as to what constitutes academic dishonesty, please consult The Golden Rule in the UCF Student Handbook (www.goldenrule.sdes.ucf.edu) for further details. As in all University courses, The Golden Rule Rules of Conduct will be applied. Violations of these rules will result in a record of the infraction being placed in your file and the student receiving a zero on the work in question AT A MINIMUM. At the instructor's discretion, you may also receive a failing grade for the course. Confirmation of such incidents can also result in expulsion from the University.

Students with Special Testing/Learning Needs:
Students with special needs and require special accommodations must be registered with UCF Student Disability Services prior to receiving those accommodations. Students must have documented disabilities requiring the special accommodations and must meet with the instructor to discuss the special needs as early as possible in the first week of classes. UCF Student Disability Services can be contacted at www.sds.sdes.ucf.edu or at (407)823-2371.

Dates:

First Day of Class	May 11th 2020
Last Day to Drop Classes:	May 14th 2020
Last Day to Add Classes:	May 15th 2020
Final Project due:	July 31st 2020

COURSE, TERM, INSTRUCTOR **Daily Schedule (subject to change)**			
Week	Date	Concepts Presented:	Textbook chapter
1		Introduction of optical design. Review of geometrical optics	Ch 1
		From Maxwell's equation to ray tracing. Snell's law/Fermat Principle.	
2		Zemax Introduction	Ch 2
		Conventions, spherical surface expansion and paraxial ray tracing approximation. Thin Lenses. Newton's formula. Thin lens system.	Ch 3
3		Matrix representation. Invariants. Paraxial ray tracing using spread sheet.	Ch 4
		Key concept for ray tracing: stops and pupils, marginal and chief ray, cardinal point, principle plane	Ch 5
4		Calculating pupils, focal length using spread sheet.	
		Non paraxial ray tracing. Wavefront/lateral aberration, MTF PSF, 3rd order aberrations I (Seidel's aberrations)	Ch 7
5		Solves and merit function	Ch 8
		Lens splitting	Ch 9, 10
6		Lens bending and aberration balancing	Ch 11
		Symmetry and periscope lens	Ch 12
7		Coma and Astigmatism	Ch 13
		Field curvature and field flattener, Distortion	Ch 14, 15
8		Axial color and achromats	Ch 16
		Achromats bending	Ch 17
9		Secondary color and large air-spaced achromat	Ch 18, 19
		Mid-term Exam	Ch 20
10		Apochromat	Ch 21
		Eyepiece Design	Ch 22
11		Field Lens and Windows	Ch 23
		Symmetric Achromat and Vignetting	Ch 25
12		Triplet Lens, Strehl Ratio	Ch 30, 31
		MTF: Image Quality V	Ch 34