Optical Systems Design (OSE 6265)

COURSE 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.

COURSE OUTLINE

1.0 Introduction
2.0 ZEMAX
3.0 Conventions and Aspheres
4.0 Paraxial World
5.0 Stops and Pupils
6.0 Glass, and the Landscape Lens
7.0 Aberrations
8.0 Solves and Merit Function
9.0 Splitting a Lens
10.0 Structural Aberration Coefficients
11.0 Lens Bending and Aberration Balancing
12.0 Symmetry and the Periscope Lens
13.0 Coma and Astigmatism
14.0 Field Curvature and Field Flattener
15.0 Distortion
16.0 Axial Color and Achromats
17.0 Bending Achromats
18.0 Secondary Color
19.0 Large Air-Spaced Achromat and French Landscape Lens
20.0 Mid-Term Exam
21.0 Apochromat
22.0 Eyepiece Design
23.0 Field Lens and Windows
24.0 Mirrors and Corrector Plates
25.0 Symmetric Achromat and Vignetting
26.0 Telescopes
27.0 Relating Defocus, Astigmatism and Field Curvature
28.0 Celor Lens
29.0 Coddington's Equations
30.0 Triplet Lens
31.0 Strehl Ratio
32.0 Axial Intensity and Depth of Focus
33.0 Petzval Lens
34.0 MTF: Image Quality V
35.0 Null Lens Design
36.0 Final Exam

TEXT (Mandatory)

Introduction to Lens Design: with Practical ZEMAX Examples
Joseph M. Geary
William-Bell, Inc. (2002)

REFERENCES

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)

Aberration Theory made Simple (TT-6)
Virendra Mahajan
SPIE Press (1991)

PREREQUISITE COURSES

Fundamentals of Applied Optics (OSE 5203), or equivalent (consent of Instructor).

GRADING

Homework:	50%
Midterm Exam:	15%
Final Exam:	25%
Quizzes & Classroom Participation	10%
	100%

INSTRUCTOR

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