OSE 5115

Interference, Diffraction and Coherence

College of Optics and Photonics, University of Central Florida

COURSE SYLLABUS

Instructor:	Pieter G. Kik	Term:	Fall 2021
Office:	CREOL A220	Class Meeting Days	T/R
Phone:	407-823-4622	Class Meeting Hours	3 PM-4:15 PM
E-Mail:	kik@creol.ucf.edu	Class Location	102 / Zoom
Website:	https://webcourses.ucf.edu	Office Hours	T/R 4:30-5:30 PM

I. University Course Catalog Description

Interference of light, optical interferometry, Fraunhofer and Fresnel scalar diffraction, diffraction gratings, temporal coherence, spatial coherence, and partial coherence

II. Course Overview

This course covers topics in optics and electromagnetics that are impacted by the wave nature of light. The course starts with a review of the necessary math, with a focus on Fourier transforms and related theorems. This is followed by a discussion of wave interference, including plane wave and spherical wave interference. Diffraction by a variety of apertures is discussed, and various related viewpoints and approximations are introduced, including the Huygens principle, Fresnel diffraction, and Fraunhofer diffraction. The use of interference in several types of applications and devices is discussed, including Newton's rings, Lloyd's mirror, and Fizeau, Michelson, Mach-Zehnder, Sagnac interferometers, grating spectrometers, Fourier transform spectrometers. The concepts of spatial and temporal coherence are introduced, and their effect on optical imaging is discussed.

III. Course Objectives and Outcomes

The students acquire an understanding of interference, diffraction, and coherence, and how these topics enable and affect imaging devices and spectral analysis tools.

IV. Course Prerequisites

Graduate Standing or C.I.

V. Course Credits

3 (3,0)

VI. Required Texts and Materials

Optics (5th Edition)	E. Hecht

VII. Suggested Texts and Materials

Introduction to Optics	F. L. Pedrotti, L. M. Pedrotti, and L. S. Pedrotti
Fundamentals of Photonics	B. E. A. Saleh and M. C. Teich
Introduction to Fourier Optics, Statistical Optics	J. W. Goodman
Principles of Optics	M. Born and E. Wolf
Systems & Transforms with Applications in Optics	A. Papoulis
Linear Systems, Fourier Transforms, and Optics	J.D. Gaskill
Optical Coherence and quantum optics	L. Mandel and E. Wolf
Optical Interferometry	P. Hariharan

VIII. Topics Covered

- Review of the Fourier transform
- Review of electromagnetic, wave propagation, and the plane-wave angular spectrum
- Two-beam interference: Mach-Zehnder interferometer, Michelson interferometer, Sagnac interferometer
- Double slit-interference
- Multiple-beam interference
- Rayleigh-Sommerfeld diffraction
- Fresnel and Fraunhofer diffraction
- Introduction to Fourier optics
- Diffraction limited optical imaging
- Diffraction Gratings
- Introduction to coherence theory
- Second-order spatial and temporal coherence
- Effect of coherence on optical imaging

IX. Zoom sessions

This course will be taught face-to-face and live-streamed over Zoom. Zoom meeting information will available on the course website on Webcourses@UCF. Lectures will be synchronous ("real time"), and class meeting recordings will be available to students registered for this class only if there are valid reasons for not attending the synchronous session.

Students are expected to follow appropriate university policies and maintain the security of passwords used to access class meetings and recorded lectures. Please take the time to familiarize yourself with Zoom by visiting the UCF Zoom Guides at https://cdl.ucf.edu/support/webcourses/zoom. You may choose to use Zoom on your mobile device (phone or tablet).

X. Basis for Final Grade

Assessment	Percent of Final Grade
Homework	20%
Midterm	30%
Final (comprehensive)	50%
	100%