UCF CREOL, THE COLLEGE OF OPTICS AND PHOTONICS

Course Catalog Description:

Course Syllabus

OSE4830 IMAGING AND DISPLAY, 3 Cr

Instructor:	Aristide Dogariu	**Term:**	Fall 2015
Email:	adogariu@creol.ucf.edu	**Class Meeting Days:**	Monday
Phone:	407 823-6839	**Class Meeting Time:**	12:00PM - 2:50PM
Office⁺:	CREOL Rm164	**Class Location**	CREOL A210

Course Catalog Description:

- Laboratory experiments introducing imaging systems.
- Interferometric metrology.
- Optical coherence tomography.
- Spectroscopy and spectral imaging.
- Display systems.

Prerequisites: EEL3123C Networks & Systems; OSE3052 Introduction to Photonics; CR: OSE4830 Imaging and Display.

Detailed Course Description and Learning Outcomes:

Detailed Description:

This laboratory accompanies the course OSE4806 Imaging and Display. It aims at providing the students with hands on experience and concrete examples of the concepts introduced in the lectures. The performance of various imaging and display systems will be simulated using MatLab image processing toolbox and measured for actual systems. The optical transfer function of an imaging system will be measured. Two interferometric axial imaging systems will be designed and tested: a surface profiling system and an optical coherence tomography system. A commercial multispectral imaging system will be used to identify various materials. The performance of a simple liquid crystal display will be assessed.

Learning Outcomes:

This lab will help the students in reaching the outcomes of OSE4830. In addition, the student will

- Use MatLab image processing toolbox for modeling of image formation and processing.
- Measure the OTF of an optical system
- Design and test an optical interferometer for surface profiling and axial imaging and assess its resolution limits.

- Use a spectrophotometer for color measurement and material identification.
- State the basic characteristics of display systems and how to measure them.

Topics:

1. **Optical Image Acquisition**
    a. Test image acquired by a camera (cell-phone USB color camera)
        i. standard imaging gauge
        ii. resolution chart
    b. MatLab image operation and processing
    c. Assess imaging performance using standard imaging gauge and adjustable optics

2. **Optical Image Processing**
    a. Build a coherent beam filtering and collimation setup
    b. Build a coherent single-lens optical processor – use standard inputs
        i. imaging
        ii. Fourier transform
    c. Build a Fourier transform and a 4f system
    d. Coherent image processing - spatial filtering
    e. Use image acquisition and MatLab Processing

3. **Optical interferometric metrology**
    a. Build a Michelson interferometer
        i. Fringe counting
        ii. Measurement of thickness/displacement
        iii. Refractive index measurement
        iv. MatLab exercise and simulation of operation
    b. Velocity measurement
        i. Doppler - piezo / mirror
        ii. MatLab exercise and simulation of operation
    c. Build a fiber based optical coherence interferometer
        i. Depth profiling, optical coherence tomography
    d. Spectral imaging
        i. Measure reflection and transmission spectra for different materials

4. **Optical Image display**
    a. LCD display
        i. Quality measures: resolution, contrast

Relationship of Course to ABET Criteria

ABET Criteria	Level of Emphasis (Low, Medium, High)
(a) An ability to apply knowledge of mathematics, science, and engineering.	Medium
(b) An ability to design and conduct experiments, as well as to analyze and interpret data.	High
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	High
(d) An ability to function on multidisciplinary teams.	High
(e) An ability to identify, formulate, and solve engineering problems.	High
(f) An understanding of professional and ethical responsibility.	Medium
(g) An ability to communicate effectively.	Low
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	Medium
(i) A recognition of the need for, and an ability to engage in life-long learning.	Medium
(j) Knowledge of contemporary issues.	Medium
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	High

Textbook:

Lab notes

Recommended References:
Introduction to Subsurface Imaging, B. Saleh, Cambridge University Press, 2011

Flat Panel displays, ST Wu

Course Grading and Requirements for Success:

Quizzes	20%
Lab activity	30%
Assigned reports	50%
Total	100%

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

Financial Aid and Attendance: As of Fall 2014, 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.

Grade	Rubric Description
A	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.
B	Good, has a strong understanding of most or all of the concepts and is able to apply them to stated and defined situations.
C	Average, has a basic understanding of the major concepts of the course and is able to apply to basic situations.
D	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.
F	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.

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	August 24, 2015
Last Day of Class	December 15, 2015