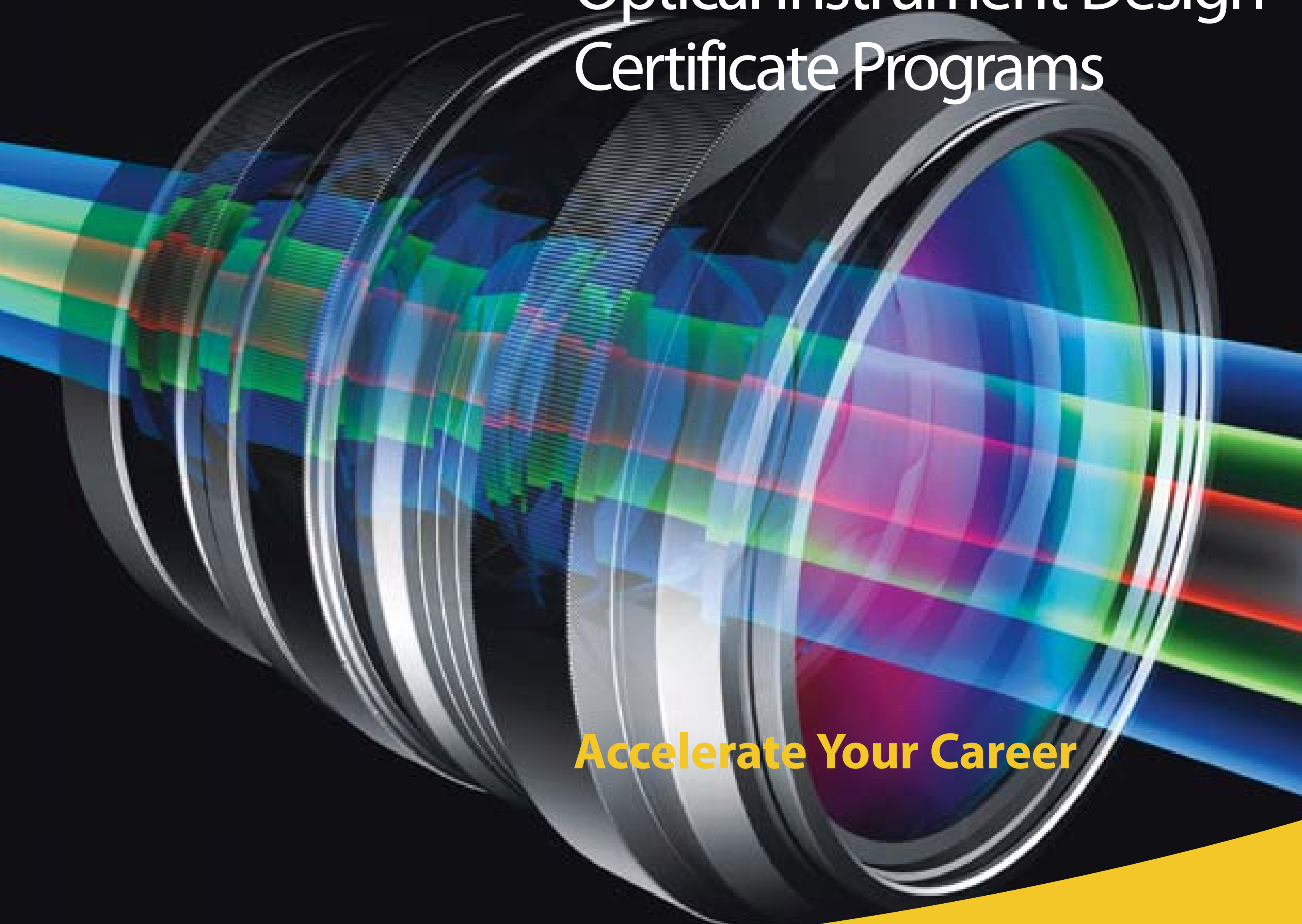
UCIrvine | Extension

Engineering

Optical Engineering
Optical Instrument Design
Certificate Programs



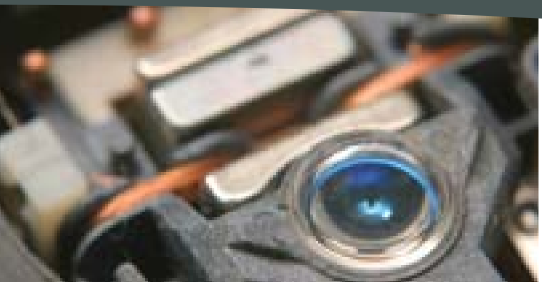
Accelerate Your Career

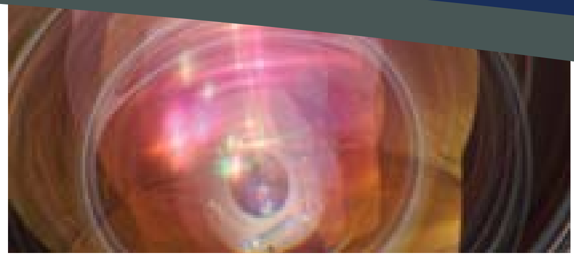
extension.uci.edu/optics

Improve Your Career Options with a Professional Certificate

In today's competitive business environment, leaders are appointed based on credentials and experience. To stay ahead of the competition, advance your career and increase your earning potential, enroll in one of University of California, Irvine Extension's professional certificate programs. Convenient and affordable, UC Irvine Extension makes it easy to learn on your own time, in your own way. Courses are designed to ensure you gain mastery of a particular topic, and instructors are highly qualified leaders in their professions.

UC Irvine Extension is the only continuing education provider in Orange County that represents the University of California. A certificate bearing the UC seal signifies a well-known, uncompromising standard of academic excellence.





Optical Engineering and Optical Instrument Design Certificate Programs

An increasing amount of today's consumer, industrial and business products incorporate optical and optomechanical systems. These systems are essential to virtually every industry including; defense, medical, clean energy, nanotechnology, automotive, electronics, communications, entertainment, computers and consumer products. The Optical Engineering and Optical Instrument Design Certificate Programs address the growing demand for skilled professionals who can conceptualize, design and manufacture these optical and optomechanical components, systems and instruments. Program attendees will gain specific skills which can be applied immediately within their organizations.

Program Benefits

- Gain useful insights and practical skills for designing and engineering optical and optomechanical components and instruments.
- Learn about the latest technologies in optical engineering including new optical materials and the latest cost effective manufacturing techniques.
- Develop skills with industry standard optical and mechanical software tools.
- Learn to develop innovative approaches for optical instrument design and analysis.
- Hands-on design courses provide skills in manual design, computer simulation, and the art of creating optical systems.
- Learn how to understand and effectively communicate details of optical/optomechanical technical specifications to manufacturer's and quality control personnel.

For more information:

Jennifer Spitzer
jspitzer@uci.edu
(949) 824-9722
extension.uci.edu/optics

Who Should Enroll

The Optical Engineering program gives students the skills and experience needed to enter this growing field. The program will also benefit those entry and mid-level professionals who need to broaden their knowledge and improve their career options.

The Optical Instrument Design program provides advanced study options for experienced optical engineering professionals allowing them to address a wider range of optical and optomechanical design issues. The elective courses provide an opportunity for students to develop specialized skills related to their professional needs or personal interests.

Certificate Prerequisite

Candidates for both programs should complete EECS X493, Introduction to Lens Design, or possess equivalent experience or education.

Certificate Requirements

An **Optical Engineering Certificate** is awarded upon the completion of 15 credit units (9 required and 6 elective credit units), with a grade of "B" or better.

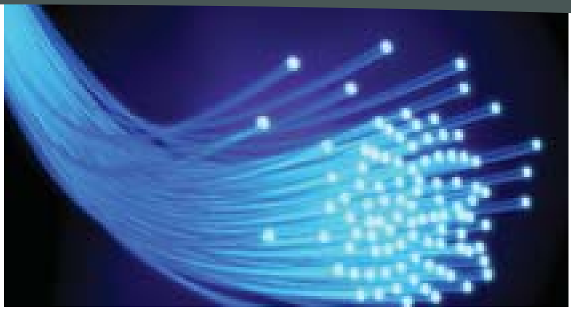
An **Optical Instrument Design Certificate** is awarded upon the completion of 15 credit units (6 required and 9 elective credit units), with a grade of "B" or better.

Developed in Conjunction With:

The Optics Institute
Of Southern California

Optical Society of Southern California

Curriculum



Prerequisite Course

Introduction to Lens Design

EECS X493 (3 units)

This practical, hands-on course will provide you with the fundamental principles in optical lens design. Participants will learn how to design simple image forming lenses and mirrors with various glasses. The knowledge and skills achieved in this course will prepare participants for advanced level study in optical design. Topics include: review of geometric and physical optics, image formation, ray tracing; aberration theory, evaluation and balancing; modeling with optical design software; 2D and 3D solid model layouts and various image evaluation tools. During the course of the class students will have access to industry standard software for optical design.

Optical Engineering Required Courses (9 units)

Advanced Lens Design

EECS X493.1 (3 units)

Become more expert in the design of optical lens design. This advanced, hands-on course will further your understanding and application of optical image evaluation techniques to design multi-element lens systems.Participants will learn how to construct merit functions for different types of lens systems including optimization, variable setting, and boundary constraints. The knowledge and skills achieved in this course will prepare participants for design engineering applications. Topics include: advanced optical image evaluation techniques, multi-element lens systems, merit functions, achromatic systems and designing with stock lenses.

Optical Systems Design

EECS X496 (3 units)

This intermediate hands-on optical systems design course will enable particiapants to combine optical elements into systems. Students will use coordinate breaks to move the system optical axis using mirrors, prisms and beam splitters and off-axis designs to tilt and de-center various optical elements. Multi element systems such as interferometers, zoom lenses and scanning systems will be reviewed, along with merit functions to determine when a particular optical system meets defined performance requirements. Various performance metrics, such as MTF, RMS, PTV and others will be used.

Optical Systems Design Part II

EECS X496.1 (3 units)

This intermediate hands-on optical systems design course focuses on analyzing the optical system performance using geometric and diffraction-based methods. These include: focus spot size, ray fan and optical path difference diagrams, field curvature and distortion, aberrations, point spread functions and modulation transfer function. In addition, thermal analysis and how to athermalize an optical system is discussed along with tolerancing and error budgets. Finally, physical optics (laser beams) is introduced through Gaussian beam propagation, analysis, control and beam characterization.

Optical Instrument Design Required Courses (6 units)

Optomechanical Components Design

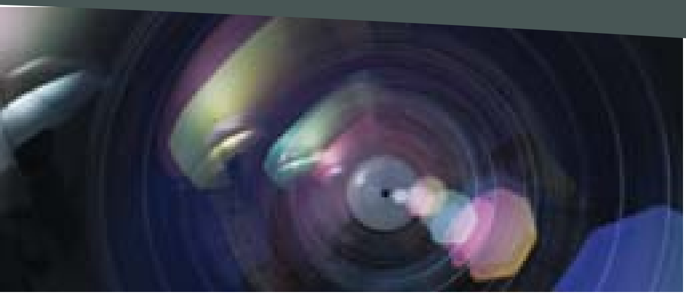
EECS X496.2 (3 units)

This introductory course fills the gap between optical and mechanical engineering by training students to integrate the optical and mechanical component designs. Students will learn how to insure their designs can be reliably manufactured and that the built and assembled optical and mechanical components perform to the original designed and modeled system. Students learn to integrate and tolerance optical and mechanical components into subsystems by exporting the optical model into the mechanical design software and performing assembly design.

Optical Instrument Design

EECS X498 (3 units)

Once students complete the Opto-Mechanical Component Design course, they are ready for the final course in the program that pulls all the material together from the Optical Engineering Program and design complete optical instruments. Here the students can integrate the concept of tolerancing optical and mechanical components as one complete integrated system. This course includes learning about designing lens assemblies with moving parts, ‘wrapping’ mechanics around the complete optical system model, stray light considerations and packaging the complete system. There are also lessons on instrument alignment strategies and procedures and final system test considerations.



Elective Courses
Optical Engineering (Choose 9 units)
Optical Instrument Design (Choose 6 units)

Geometrical Optics
EECS X496.51 (3 units)
In this course you will be introduced to the principles and use of optical components and systems. This course surveys geometrical optics covering plan surfaces, prisms, spherical surfaces, lenses, and mirrors for use in optical systems. Special topics include optical instruments; like telescopes, microscopes, beam projectors, cameras and optical measuring benches. The classes will provide a balanced mix of lectures and hands-on laboratory experiments for those that are interested in entering fields where optics are used.

Physical Optics
EECS X496.52 (3 units)
This is part 2 of the beginning course in optics and introduces the principles and nature of optical phenomenon in systems. This course surveys physical optics covering diffraction, interference and polarization as they are observed in nature and used in optical systems. Introductory and some complex concepts are reviewed both mathematically and experimentally. The classes will provide a balanced mix of lectures and hands-on laboratory experiments for those that are interested in entering fields where optics are used.

Introduction to Lasers
EECS X493.55 (3 units)
This course is intended to expose students to the basic physical and engineering principles of lasers and review different types of lasers. Topics include spontaneous and induced transitions between atomic levels, absorption and amplification, optical resonators, Gaussian beams, three- and four-level lasers, mode-locked and Q-switched lasers, and specific laser systems: Nd:YAG and other solid-state lasers; He-Ne, argon-ion, carbon dioxide lasers and other gas lasers; semiconductor diode lasers; and laser applications.

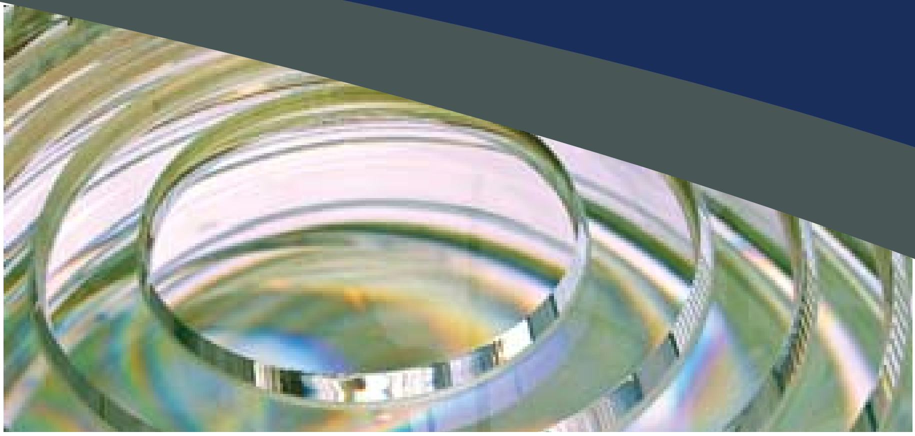
Introduction to Fiber Optics
EECS X493.56 (3 units)
This course introduces the student to the properties of light, characteristics and control of LEDs (light emitting diodes) and lasers, fabrication of optical fiber, transmission of information via light, and fiber-optic transmission networks are covered. Topics emphasize devices, system analysis and design, including internal and external laser modulation, light coupling to fiber, fiber waveguide dispersion, attenuation and scattering phenomena, connectors, couplers, splitters, amplifiers, photo detectors, and receivers for digital and analog applications. Class will analyze and design a fiber optic link.

Optical Metrology and Interferometry
EECS X496.53 (3 units)
Theory, design and demonstrations of commonly used interferometers will be presented. A commercial Fizeautype interferometer will be used to make routine metrology measurements of precision optical components. Interfero gram analysis by hand calculation will be compared with results from various freeware fringe analysis programs.

Introduction to SolidWorks
EECS X493.57 (3 units)
3D CAD solids modeling instruction topics include: parts, assemblies, documentation, drawings, structural weldments, photorealistic rendering, animation, simple static stress analysis, and the SolidWorks DWG editor, demonstrations of SolidWorks 2007-2008 w/Smartfeatures. The course will also cover how to use solid modeling in the context of OptoMechanical Design.

Precision Positioning and Motion Control for Optical Systems
EECS X493.54 (3 units)
Micro and Nano positioning solutions for advanced optical systems are key to many high-tech instruments in many fields. This course provides the fundamentals for understanding these key motion control technologies as they are used in different technology fields from semiconductors to biotechnology and telecommunications.

Introduction to Vibration Control
EECS X496.58 (3 units)
The course will discuss ways in which vibration may affect optical performance, as well as methods and means of reducing this impact. Principal methods of vibration control, such as damping and isolation will be discussed using mathematical models and real life examples. Vibration measurements and environmental standards will be presented as applicable to optomechanical systems. State-of-the art vibration control systems will be reviewed, including pneumatic and elastomeric isolators, damping treatments and active control systems.



Advisory Committee

Ed Arriola, Chief Engineer, LightWorks Optics

Arnie Banzensky, Field Sales Manager, Schott Glass Technologies

Valentina Doushkina, M.Sc., Director of Engineering, Qioptiq Polymer

Derek Dunn-Rankin, Ph.D., Professor and Chair, Mechanical & Aerospace Engineering, UCI

Mark Gallagher, Ph.D., J.D, Partner, Knobbe, Martens, Olson & Bear, LLP

Charles Gaugh, Technical Director & Sales Manager, Davidson Optronics

G.P. Li, Ph.D., Professor, The Henry Samueli School of Engineering; Director, California Institute for Telecommunications and Information Technology, UCI

Jeff Padgett, Optomechanical Engineering Technician, Wavetec Vision, Inc.

Forrest Reynard, President, Reynard Corporation, Advanced Optical Solutions

T. Scott Rowe, Principal, Rowe Technical Design

Donn M. Silberman, M.S., Founding Director, Optics Institute of Southern California; Sr. Applications Engineer, PI (Physik Instrumente)

James D. Trolinger, Ph.D., Co-Founder, MetroLaser, Inc.

Bruce Tromberg, Ph.D., Professor, College of Medicine, Biomedical Engineering; Director, Beckman Laser Institute and Medical Clinic, UCI

Wytze van der Veer, Ph.D., Director of the UC Irvine Laser Spectroscopy, UCI

Desiré Whitmore, Ph.D. Candidate, Chemical & Material Physics Department, UCI

Optical Engineering
Optical Instrument Design
Certificate Programs

UCIrvine | Extension

extension.uci.edu/optics ■ (949) 824-9722

Printed on Recycled Paper