California State University Channel Islands

NEW COURSE PROPOSAL

Courses must be submitted by October 15, 2013, and finalized by the end of that fall semester for the next catalog production.

Use YELLOWED areas to enter data.

DATE 10/14/13; REV 11.12.13

PROGRAM AREA(S) APPLIED PHYSICS

1. Course Information. *[Follow accepted catalog format.]*

Prefix(es) (Add additional prefixes if cross-listed) **PHYS 410**

Title: **INTRODUCTION TO ELECTRO-OPTICS** **Units: 4.0**

x Prerequisites Physics 201 or consent of the instructor

Corequisites none

Consent of Instructor Required for Enrollment

Catalog Description (Do not use any symbols): **Introduction to the theory, operation, and applications of lasers and associated optical and electro-optical devices. Laboratory stresses safety procedures, use of instrumentation, assembly of components, and measuring techniques suitable for a typical research environment.**

Grading Scheme:	**Repeatability:**	**Course Level Information:**
x A-F Grades	Repeatable for a maximum of units	x Undergraduate
Credit/No Credit	Total Completions Allowed 1	Post-Baccalaureate/Credential
Optional (Student Choice)	Multiple Enrollment in Same Semester	Graduate

Mode of Instruction/Components (*Hours per Unit are defaulted*).

	Units	**Hours per Unit**	**Benchmark Enrollment**	**Graded Component**	**CS & HEGIS #** (Filled in by the Dean)
Lecture	3.0	1	15	x	
Seminar		1			
Laboratory	1.0	3	15	x	
Activity		2			
Field Studies					
Indep Study					
Other Blank					

Leave the following hours per week areas blank. The hours per week will be filled out for you.

3 hours lecture per week

3 hours laboratory per week

Is this course always delivered online? Yes_____ No__x__ (Answer YES if the course is ALWAYS delivered online).

2. Course Attributes:

General Education Categories: All courses with GE category notations (including deletions) must be submitted to the GE website: http://summit.csuci.edu/geapproval. Upon completion, the GE Committee will forward your documents to the Curriculum Committee for further processing.

A (English Language, Communication, Critical Thinking)

A-1 Oral Communication

A-2 English Writing

A-3 Critical Thinking

B (Mathematics, Sciences & Technology)

B-1 Physical Sciences

B-2 Life Sciences – Biology
B-3 Mathematics – Mathematics and Applications
B-4 Computers and Information Technology

C (Fine Arts, Literature, Languages & Cultures)

C-1 Art
C-2 Literature Courses
C-3a Language
C-3b Multicultural

D (Social Perspectives)
E (Human Psychological and Physiological Perspectives)
UDIGE/INTD Interdisciplinary
Meets University Writing Requirement (Graduation Writing Assessment Requirement)
Meets University Language Requirement

American Institutions, Title V Section 40404: Government US Constitution US History
Regarding Exec Order 405, for more information: http://senate.csuci.edu/comm/curriculum/resources.htm
Service Learning Course (Approval from the Center for Community Engagement must be received before you can request this course attribute).
Online Course (Answer YES if the course is ALWAYS delivered online).

3. Justification and Requirements for the Course. (Make a brief statement to justify the need for the course)

A. Justification: Electro-optics (aka "Photonics") is an important component of any applied physics and/or engineering curriculum. Lasers and associated devices are found in a wide-range of modern technologies, from fiber optic communication systems to surgical instruments. Student interest in the subject was demonstrated by the 19 students who enrolled in an initial "trial run" of the curriculum that was offered as a Physics 490 course in the Fall 2013 semester.

B. Degree Requirement:
Requirement for the Major/Minor
x Elective for the Major/Minor
Free Elective

Note: Submit Program Modification if this course changes your program.

4. Student Learning Outcomes. List in numerical order. Please refer to the Curriculum Committee's "Learning Outcomes" guideline for measurable outcomes that reflect elements of Bloom's Taxonomy: *http://senate.csuci.edu/comm/curriculum/resources.htm*. The committee recommends 4 to 8 student learning outcomes, unless governed by an external agency (e.g., Nursing).

Upon completion of the course, the student will be able to:

1. Safely operate various electro-optical devices and communicate safety instructions to others,
2. Collect, interpret and verify data from electro-optical devices for typical laboratory measurements,
3. Compare the suitability of various electro-optical instruments for typical measurements,
4. Perform computations elucidating the operating principles of various electro-optical devices,
5. Report results of experiments using format and language appropriate for scientific publication,
6. Design and perform experiments employing electro-optical devices.

5. Course Content in Outline Form. *[Be as brief as possible, but use as much space as necessary]*

1. Review of Optics
    a. Optical elements: mirrors, lenses, filters, beam splitters, prisms, diffraction gratings, optical fibers
    b. Matrix optics and the ABCD system matrix
    c. Polarization and polarizing optical elements
    d. Optical activity
    e. Basic optical instruments: telescopes, beam expanders, collimators
2. Coherent vs. Incoherent Light Sources

a. Coherence length
b. Irradiance
c. Beam Divergence, minimum waist size
d. Gaussian Beam Propagation calculations

3. Laser Safety
    a. Laser safety classifications
    b. Spectral vs. Diffuse reflections
    c. Eye protection
        i. Wavelength considerations
        ii. Pulsed vs. CW Lasers
    d. Electrical hazards
    e. Chemical hazards
    f. Other safety considerations
        i. Proper Isolation of Laser Beams
    g. Laser safety certification

4. Laser Fundamentals
    a. Elements and Operation of a Laser
        i. The optical resonator
        ii. Pumping schemes
            1. Power requirements
            2. Thermal considerations
    b. Emission and Absorption of Light
    c. Optical Gain
    d. Three vs. Four-level Lasers
    e. Optical Cavities and Laser Modes
    f. Temporal Characteristics of a Laser
    g. Spatial Characteristics of a Laser

5. Laser Systems
    a. Gas Lasers: Atomic, Ionic, and Molecular
    b. Solid lasers: Three and Four-Level Systems
    c. Solid State Lasers,
        i. Diode Laser Architectures
        ii. Diode Laser Characteristics
        iii. Distributed Feedback Lasers
        iv. Diode Laser Arrays
        v. New Technologies
    d. Liquid Gain Media
        i. Organic Dye Lasers
            1. Cuvette-style systems
            2. Dye jet systems
    e. Other Novel Laser Systems
        i. Free Electron Lasers (FELs)
        ii. Excimer Lasers
        iii. Parametric Oscillators
        iv. Laser Gyroscopes
        v. New Technologies

6. Electro-Optic and Optical Devices
    a. Optical Tables and Breadboards
    b. Optical Mounts
        i. Lens and Mirror Mounts
        ii. Rotational and Translational Stages
        iii. Other Optical Hardware
    c. Beam Manipulation
        i. AO and EO Modulators
        ii. Beam Steering
        iii. Beam Expanders and Collimators

iv. Optical Filters and Other Attenuators
v. Spatial Filtering
vi. Optical Elements and the Fourier Transform

7. Laser Systems and Applications
    a. Industrial Applications
    b. Medical Applications
    c. Scientific Applications
    d. Other Applications

8. Semester Project
    a. Written Project Report
    b. Oral Presentation

Does this course content overlap with a course offered in your academic program? **Yes** **No** x
If YES, what course(s) and provide a justification of the overlap.

Does this course content overlap a course offered in another academic area? **Yes** **No** x
If YES, what course(s) and provide a justification of the overlap.

Overlapping courses require Chairs' signatures.

6. Cross-listed Courses (*Please note each prefix in item No. 1)*

A. List Cross-listed Courses (Signature of Academic Chair(s) of the other academic area(s) is required).
List each cross-listed prefix for the course:

B. Program responsible for staffing: Applied Physics

7. References. *[Provide 3 - 5 references]*

Lasers, Anthony E. Siegman, University Science Books, (1986) ISBN-13: 978-0-935702-11-8

Principles of Lasers, 5th Edition, Orazio Svelto, Springer, (2010) ISBN-10: 1441913017

Fundamentals of Photonics, 2nd Edition, Bahaa E.A. Saleh & Malvin C. Teich, Wiley Series in Pure and Applied Optics, (2007) ISBN-13: 978-0471358329

Building Electro-Optical Systems, Making It All Work, 2nd Edition, Philip C.C. Hobbs, Wiley Series in Pure and Applied Optics, (2009) ISBN-13: 978-0470402290

Laser Electro-Optics Technology Series, OP-TEC: The National Center for Optics and Photonics Education, CORD Communications (2013) ISBN (various, series of books)

8. Tenure Track Faculty Qualified to Teach This Course.

Geoff Dougherty, Ph.D.
Gregory G. Wood, Ph.D.

9. Requested Effective Date:

First semester offered: Fall 2014

10. New Resources Requested. Yes **No** x

If YES, list the resources needed.

A. Computer Needs (data processing, audio visual, broadcasting, other equipment, etc.)

B. Library Needs (streaming media, video hosting, databases, exhibit space, etc.)

C. Facility/Space/Transportation Needs

D. Lab Fee Requested (please refer to Dean's Office for additional processing) **Yes** **No**

E. Other

11. Will this new course alter any degree, credential, certificate, or minor in your program? Yes x **No**
If, YES attach a program update or program modification form for all programs affected.
Priority deadline for New Minors and Programs: October 1, 2013 of preceding year.
Priority deadline for Course Proposals and Modifications: October 15, 2013, of preceding year.
Last day to submit forms to be considered during the current academic year: April 15th.

Clint D. Harper, Ph.D. and Geoff Dougherty, Ph.D. 10/14/13

Proposer of Course (Type in name. Signatures will be collected after Curriculum approval) Date

Approval Sheet

Program/Course:

If your course has a General Education Component or involves Center affiliation, the Center will also sign off during the approval process.

Multiple Chair fields are available for cross-listed courses.

The CI program review process includes a report from the respective department/program on its progress toward accessibility requirement compliance. By signing below, I acknowledge the importance of incorporating accessibility in course design.

Program Chair		
	Signature	Date
Program Chair		
	Signature	Date
Program Chair		
	Signature	Date
General Education Chair		
	Signature	Date
Center for International Affairs Director		
	Signature	Date
Center for Integrative Studies Director		
	Signature	Date
Center for Multicultural Engagement Director		
	Signature	Date
Center for Civic Engagement Director		
	Signature	Date
Curriculum Chair		
	Signature	Date
AVP		
	Signature	Date