All Fields Report

Basic Course Information	
College	Cañada College
Discipline	PALT-Photonics and Laser Technology
Course Number	409
Full Course Title	Advanced Photonics Technology
Catalog Course Description	A hands-on introduction to advanced photonics and laser technologies. Topics include: ultrashort pulse propagation; nonlinear optics; synchrotron and other advanced light sources; photonic crystals; generation and measurements of ultrashort pulses.
Class Schedule Course Description	A hands-on introduction to advanced photonics and laser technologies. Topics include: ultrashort pulse propagation; nonlinear optics; synchrotron and other advanced light sources; photonic crystals; generation and measurements of ultrashort pulses.
Proposal Information	
Proposed Start	Year: 2021 Semester: Fall
Proposed Curriculum Committee Meeting Date:	01/22/2021
Deadline for submission to Dean's Queue:	12/17/2020
Deadline for submission of curriculum proposal to the Technical Review Committee:	12/29/2020
Proposal Origination Date:	10/13/2020
Justification For Board Report OR Curriculum Inventory update:	1. For NEW Courses: Provide a brief justification statement describing the need for the course, its place in the curriculum, and pertinent information such as the role of advisory committees. New courses require approval of the SMCCCD Board of Trustees. The justification statement will be included on the annual Curricular Board report. Use complete sentences and present tense. 2. For all types of Course MODIFICATIONS (modifications, banking, deletions and reactivations): Provide a brief justification statement describing the need for the change. The justification statement will be used for course updates in the State Curriculum Inventory as necessary. Use complete sentences and present tense. The course content is recommended by the Advisory Board. It provides students with a review of cutting-edge technologies in photonics and lasers. Students will also receive hands-on training in advanced photonics and laser technologies. This course is a core requirement for the Certificate of Achievements in Advanced Photonics and Laser Technology.
Honors Course	No
Open Entry/Open Exit	No 0

Equivalent Courses	
Will this course replace an existing course in the catalog, or an experimental course?	No
If yes, identify and explain.	
Similar Courses	

Is there a similar or equivalent course in SMCCCD?	No
Added Similar Courses	

Units/Hours

Unit Types	Fixed
Units	Min: 3.00
Variable Range	Range (or)

Hours

Please enter hours as per term values

Method	Min Hours	Max Hours	Min Faculty Load	Min Units
Lecture	32.00	36.00	2.00	2.00
Lab	48.00	54.00	2.40	1.00
TBA	0.00	0.00	0.00	0.00
Work Experience	0.00	0.00	0.00	0.00
Field Experience	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00
Homework	64.00	72.00	0.00	0.00

Other Hours	

Course Details

Repeatable for Credit	No
Grading Methods	Letter Grade Only
Audit	Yes

Materials Fee

Fee Required?	No

Student Learning Outcomes

Upon successful completion of this course, a student will meet the following outcomes:

1. Use principles of optics and photonics to solve problems in advanced optics.
2. Demonstrate the ability to work in teams to gather and analyze data and prepare technical reports describing experimental work.
3. Work independently to prepare and deliver presentations of design projects by use of presentation software (like libreoffice impress or powerpoint).

Course Objectives

Upon successful completion of this course, a student will be able to:

1. Apply principles of pulse propagation to identify properties of ultrafast light dispersion through media.
2. Apply principles of nonlinear optics to identify light behavior through nonlinear media.
3. Distinguish between the characteristics of advanced light sources.
4. Learn to safely use ultrafast laser pulses.
5. Learn to characterize the properties of ultrafast pulses.

Course Lecture Content

1. Gaussian Beams
    1. Propagation
    2. Short pulse gaussian beams
2. Fourier transform and spatial harmonic analysis
    1. Far field fourier transform
    2. Lens as a fourier transformer
3. Fresnel and Fourier diffractions
    1. Holography
4. Representation and propagation of ultrashort pulses
    1. Time domain
    2. Frequency domain and fourier relations
5. Dispersion of optics
    1. Group delay dispersion
    2. Group velocity dispersion
    3. Third order dispersion
    4. Time-frequency representations
    5. Pulse stretching and compression
6. Nonlinear optics
7. Fundamental mechanisms
    1. Electron cloud distortion
    2. Other nonlinear m echanisms
8. Second Harmonic Generation
    1. Sum frequency generation
    2. Parametric amplification
    3. Kerr-Eefect
    4. Three-wave mixing
    5. Four-wave mixing
9. Nonlinear refractive index
    1. Optical switching
    2. Pulse chirping and temporal
    3. Solitons
    4. Pulse compression
    5. Self-focusing and spatial
10. Electro-optic effects
    1. Pockels effect
    2. Kerr electrooptic effect
11. Light sources
    1. Radiation from moving charged particle
    2. Synchrotron radiation
    3. Undulator radiation
    4. Free-eletron laser
    5. Thomson scattering
12. Photonic crystal optics
    1. 1-D photonic crystals
    2. Step-index grating
    3. Sinusoidal index grating
    4. Photonic band gap
    5. 2-D photonic crystals
    6. Planar geometry
    7. Fiber geometry
    8. 3-D photonic crystals

Course Lab Content

1. Fourier Optics
    1. Building a 4f set-up
    2. Manipulating images
2. Non-linear optical thermal lensing
    1. Lens formation of a lens in an absorbing medium
    2. Radius measurement of a Gaussian beam using the knife-edge method
    3. Estimating the focal length of the induced thermal lens.
3. Non-linear optical frequency doubling
    1. External Frequency Doubling of a Q-switched Laser using LBO.
    2. Measure Conversion efficiency as a function of peak power and spot diameter
4. Operating an ultrafast laser
    1. Measuring CW laser power output as function of pump power
    2. Obtaining modelocking in an ultrafast laser
    3. Role of pump power and polarization on modelocking
5. Measurement of pulse duration
    1. Using autocorrelation to measure pulse duration
6. Measurement of fiber dispersion
    1. Fiber length dependence of ultrashort pulse dispersions
7. Advanced laser experiments
    1. Stretching of an ultrafast laser pulses using Transmission grating
    2. Characterization of Prism and Grating Compressors
    3. External Frequency Doubling of a Q-switched Laser using LBO.
    4. Measuring Conversion efficiency as a function of peak power and spot diameter

TBA Hours Content

Frequently Recommended Preparation

Frequently Recommended	

Justification for Frequently Recommended Preparation

Why is the knowledge of the recommended course(s), skill(s) or information necessary for students to succeed in the "target" course? Specify the relationship between the recommended knowledge and skills required of students and those taught in the "target course? (Please list the specific proficiencies students must possess in order to succeed in the "target" course.)

Other Recommended Preparation

You have no defined requisites.

Prerequisites/Corequisites

Drag and Drop to Reorder

Edit/Delete	Requisites	Analysis
	Prerequisite PALT 405	

Content Review

PALT 405 - Prerequisite

(Objective to Objective)
Launched

Mode of Delivery

Modes of Delivery
Hybrid Lecture Lab

Representative Instructional Methods

Methods	Lecture Lab Experiments Guest Speakers Other (Specify)
Other Methods	The course will be supplemented by technology and by video and/or Web-based content as appropriate.

Representative Assignments

Writing Assignments
(List all assignments, including library assignments. Outside assignments are not required for lab-only courses, although they can be given.)

1. Weekly report of design, modeling and analysis of advanced photonics and laser technologies (1-3 pages in length).
2. Weekly Laboratory report (5-10 pages) for each laboratory experiment summarizing objectives, procedures, results and conclusions.
3. Up to two Project reports (10-20 pages per report) that discuss objectives, methods of approach, solution, and results following engineering technical writing guidelines.

and conclusions.

Reading Assignments
(List all assignments, including library assignments. Outside assignments are not required for lab-only courses, although they can be given.)

1. Weekly textbook or handout readings (20 pages).
2. Monthly Reading of laboratory handouts (20-50 pages)
3. Monthly Reading of journal or technical articles in advanced photonics (5-10 pages)

Other Outside Assignments
(List all assignments, including library assignments. Outside assignments are not required for lab-only courses, although they can be given.)

- Out of class assignments will be in keeping with the goals and objectives of the course. The use of critical thinking is required for the students to apply the principles of photonics to advanced optical system operation. Students are expected to complete a minimum of two hours of outside assignments for each hour of classroom lecture.

To be Arranged Assignments
(List all assignments, including library assignments. Outside assignments are not required for lab-only courses, although they can be given.)

- Not applicable

Representative Methods of Evaluation

This section defines the ways students will demonstrate that they have met the student learning outcomes.

Student grades will be based on multiple measures of student performance. Instructors will develop appropriate classroom assessment methods and procedures for calculating student grades, including the final semester grade. The following list displays typical assessment methods appropriate for this course. The actual assessment methods used in a particular classroom and section will be listed in the instructor?s syllabus.

Methods must effectively evaluate critical thinking. Credit courses must include written communication, problem solving, and/or skills demonstrations.

Multiple measures may include, but are not limited to, the following:

Methods	• Exams/Tests • Homework • Lab Activities • Oral Presentation • Quizzes • Written examination

Representative Texts

Textbooks such as the following are appropriate:

Formatting Style	APA

Textbooks

	1. Menzel, R.. *Photonics: Linear and non-linear interactions of laser light and matter*, 2 ed. Springer, 2005
	2. Justin Peatross, Michael Ware. *Physics of Light and Optics*, 2 ed. Brigham Young University, 2015
	3. Bahaa E. A. Saleh, Malvin Carl Teich. *Fundamentals of Photonics*, 3 ed. Wiley, 2019

Manuals

You have no manuals defined.

Periodicals

You have no periodicals defined.

Software

You have no software defined.

Other

You have no other defined.

Degree/Certificate Applicability	
Designation	Degree Credit
Proposed For	Certificate/Skill Award
Course Designation Text	Are there degrees/certificates to which this course applies? CA in Advanced Photonics and Laser Technology

General Education/Degree/Transfer Course	
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CSU Transfer Course	
	Transfers to CSU Approved

Course Distance Education	
Distance Ed Supplement	New distance education supplement
Distance Education	Distance education component was developed by an instructor with training in online pedagogy. Training: QOTL or equivalent Course at Canada College
Method of Distance Education	Online, Hybrid, Web Assisted Course; (If there are limitations on how this course would be offered please explain below)
Online Method Limitations	Students will need to come to campus to access lab facilities
Other Methods	
Course Content and Methodology	The objectives and content of the course are adequately covered by the methods of instruction, assignments, evaluation of student outcomes, and instructional materials.
Instructional Methodologies (How will you deliver the course content?):	Announcements/Bulletin Boards E-mail One-Way Video Conferencing (One-way interactive video and two-way interactive audio) Online Presentations Resource Links Two-Way Video conferencing (Two-way interactive video and audio)
Representative Courseware/Textbooks Materials:	Possible textbooks include: Justin Peatross, Michael Ware. Physics of Light and Optics, 2 ed.Brigham Young University, 2015 Bahaa E. A. Saleh, Malvin Carl Teich. Fundamentals of Photonics, 3 ed.Wiley, 2019 Menzel, R.. Photonics: Linear and non-linear interactions of laser light and matter, 2 ed.Springer, 2005
Methods of Evaluation of Student Performance:	Multiple types of formative and summative assessments will be used 1. Bi-weekly assessment of laboratory reports that will be submitted online 2. Weekly assessment of homework assignments that will be submitted online
How are you ensuring that students with disabilities can access your course in accordance with Section 508?	Instructional materials have been tagged to indicate organizational structure and reading order. Images, tables and/or diagrams include textual representations. If applicable, the instructor will ask the publisher or content provider to provide a Voluntary Product Accessibility Template (VPAT) which evaluates how accessible the product is according to section 508 standards.

Plan for Regular Effective Communication Contact Between Faculty and Student (Title 5, 55204). "Local policies should establish and monitor minimum standards of regular effective

contact."
Announcements/Bulletin Boards - Communication will occur at least two times a week. This will include course content as well as information on homework, labs, quizzes and tests. In addition, STEM related opportunities will also be announced at least once a month.
Email Communication - Response by email within 24-48 hours
Office hours - Weekly office hours held via video or phone call
Other (explain) - One ore more lesson content will be delivered each week by the online learning management platform

Resources Needed	
Adequate Library Resources	Consultation with the Coordinator of Library Services regarding the adequacy of campus and online information resources to fulfill course objectives is required prior to course approval. Inadequate to support the course Please Specify:
Affected Resources	Which of the following resources do you expect to be affected by the offering of this class? Check as many as appropriate. New equipment needs
Explain what effect the areas you have checked will have upon this college:	

Comparable Transfer Course Information	
Are there comparable courses?	Yes
Edit/Del	**College Info**

Minimum Qualification
No Minimum Qualifications For this Course

CB Codes	
CB03 TOP Code	0934.80 - Laser and Optical Technol
CB04 Course Credit Status	D - Credit - Degree Applicable
CB05 Course Transfer Status	B = Transferable to CSU only
CB08 Course Basic Skill Status (PBS Status)	2N = Course is not a basic skills course.
CB09 SAM Code	B - Advance Occupational
CB11 California Classification Codes	Y - Credit Course
CB21 Levels Below Transfer	Y = Not Applicable
CB23 Funding Agency Category	A = Fully Economic Development funds

CB25 Course General Education Status	Y - Not Applicable
CB26 Course Support Course Status	N - Course is not a support course

Codes/Dates

Entry of Special Dates

Instruction Office Review	01/22/2021
Last Outline Revision	
Content Review	01/22/2021
CC Approval	01/22/2021
DE Approval	01/22/2021
Effective Term	Term: Fall Year: 2021

Web Catalog

Course Family	
Web Catalog	☐ Exclude from Web Catalog

Instructional Services

Implementation Date	

Originator	Ramki Kalyanaraman
Origination Date	10/13/2020
Proposal Type	Cañada New Course
C-ID Numbers	
CB00 State ID	
CB03 TOP Code	0934.80 - Laser and Optical Technol
CB04 Course Credit Status	D - Credit - Degree Applicable
CB05 Course Transfer Status	B = Transferable to CSU only
CB08 Course Basic Skill Status (PBS Status)	2N = Course is not a basic skills course.
CB09 SAM Code	B - Advance Occupational
CB10 Course COOP Work Exp-ED	N = Not part of Coop Work Exp
CB11 California Classification Codes	Y - Credit Course
CB13-Special Class Status	N - Not Special
CB21 Levels Below Transfer	Y = Not Applicable
CB22 Non Credit Course Category	Y - Not Applicable
CB23 Funding Agency Category	A = Fully Economic Development funds
CB24-Program Course Status	1 = Program Applicable
CB25 Course General Education Status	Y - Not Applicable
CB26 Course Support Course Status	N - Course is not a support course

Web Catalog Metadata