All Fields Report

Basic Course Information	
College	Cañada College
Discipline	PALT-Photonics and Laser Technology
Course Number	403
Full Course Title	Optics and Photonics Modeling and Design
Catalog Course Description	A hands-on introduction to modeling, analysis, and design of optical and photonics systems using matrix based computational programming (MATLAB or Octave) and commercial optical design software like ZEMAX. Topics Include: plotting and data visualization; use of arrays to understand image processing; design of optical and photonic systems using the ZEMAX software (or similar commercial software software).
Class Schedule Course Description	A hands-on introduction to modeling, analysis, and design of optical and photonics systems using matrix based computational programming (MATLAB or Octave) and commercial optical design software like ZEMAX. Topics Include: plotting and data visualization; use of arrays to understand image processing; design of optical and photonic systems using the ZEMAX software (or similar commercial software software).
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 necessary hands-on skills to design and analyze optical systems based on utilizing industry recommended software and modeling tools. This course is a core requirement for the Certificate of Achievements in Photonics and Laser Technology and 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,	No

or an experimental course?	
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 an engineering programming language (like Octave or MATLAB) as a computational tool to solve problems in optics and photonics technology, mathematics, and the sciences.
2. Use an engineering programming language (like Octave or MATLAB) as a plotting and visualization tool.
3. Utilize a commercial photonics software (like ZEMAX) to model the behavior of optical and photonic system.
4. Utilize a commercial optics and photonics software (like ZEMAX) to design nad test optical and photonics systems.
5. Demonstrate ability to work in teams to carry out engineering design projects.
6. Demonstrate the ability to work in teams to gather and analyze data and prepare technical reports describing experimental work.
7. Work independently to prepare and deliver presentations of design projects 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 Octave/MATLAB as a computational tool to solve problems in optics and photonics technology, mathematics, and engineering.
2. Use Octave/MATLAB as a plotting and visualization tool.
3. Design, implement, and test an optical imaging system using commercial software.
4. Design, implement, and test an optical illumination system using commercial software.
5. Model the propagation of a gaussian laser beam using commercial software.
6. Design, implement, and test a spectrometer using commercial software.
7. Learn to apply engineering design approach to perform optical and photonic component design.

Course Lecture Content

1. Octave (Matlab) problem solving and programming
    a. Introduction to computers, programming, and the Octave/MATLAB environment
    b. Array and matrix basics
    c. Variables, expressions, and order of operation
    d. Formatted input and output
    e. Plotting and Visualization
    f. Image Analysis
2. Getting started with commercial Photonics software (like ZEMAX OpticStudio)
    a. Explore the OpticStudio interface and the range of capabilities with these introductory resources. This is the jumping off point for the other OpticStudio Learning paths.
3. Imaging system fundamentals
    a. Setting up your system
    b. Analyzing your system
    c. Improving your system
    d. Tolerancing
    e. Share your system as a CAD file
    f. Share your system as an ISO 10110 compliant drawing
4. Illumination systems fundamentals
    a. Basics of illumination system
    b. The materials used in illumination systems
    c. Illumination design methods
    d. Illumination lens design forms

e. Exporting our illumination system results

5. Modeling laser beam propagation with commercial OAPT software (like ZEMAX OpticStudio)
    a. Gaussian beam theory and ray-based approach
    b. Using the Paraxial Gaussian Beam analysis
    c. Using Physical Optics Propagation to model Gaussian beams
6. Building a spectrometer
    a. Theory
    b. Implementation
    c. Tolerancing
    d. Stray Light Analysis
7. Optical performance, prescription and Manufacturing data with commercial OAPT software (like ZEMAX OpticsViewer)
    a. File viewing and sharing
    b. Technical drawings
    c. Performance analysis
    d. Parameter visualization
    e. Real-time lens prototype costs in OpticsViewer
8. Introduction to commerical photonics Programming Language (like ZPL)
    a. How to write a ZPL macro
    b. How to create a user-defined solve
    c. ZPLM: optimization using a ZPL Macro
9. Getting started with commercial Photonics and Laser Technolog software (like ZEMAX OpticsBuilder)
    a. Prepare for OpticsBuilder
    b. How to load an OpticsBuilder (.ZBD) file
    c. How to perform a simulation in OpticsBuilder
    d. OpticsBuilder drawing tutorial

Course Lab Content

1. Modeling of Gaussian Beams
    1. Set up and analyze laser beam propagation, and optimize for the smallest beam size in a simple singlet lens system in OpticStudio sequential

2. Use the Physical Optics Propagation (POP) tool to find the best focus of the laser beam mode
2. Design and modeling of a Singlet Lens
    1. Design a singlet lens
    2. Analyzing its performance
    3. Optimizing it for the required prescription and design constraints.
3. Illumination lens design
    1. Create a simple non-sequential system
    2. Model an LCD backlight
    3. Create a Fly's eye array for uniform illumination in digital projector optics
    4. Create complex non-sequential objects
4. Design a Hologram
    1. Model holograms in OpticStudio
    2. Analyze hologram construction fringes with a ZOS-API
    3. Use an Optically Fabricated Hologram
    4. Model a holographic waveguide for AR systems
    5. Simulating diffraction efficiency of a volume holographic gratings

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 Completion of, or concurrent enrollment in	
	Prerequisite PALT 402	

Content Review

PALT 402 - Corequisite
(Objective to Objective)
Launched

Mode of Delivery

Modes of Delivery
Online Hybrid

Lecture

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 photonic systems using computational methods (1-3 pages in length).
2. Weekly Laboratory report (5-10 pages) for each laboratory experiment summarizing objectives, procedures, results and conclusions
3. Monthly formal laboratory report (10-20 pages) following engineering technical writing guidelines.

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 readings (50 pages).
2. Weekly Reading of laboratory handouts (2-20 pages)
3. Monthly Reading articles on photonics and laser technology topics (2-6 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 optics to optical system design. 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	• Group Projects • Homework • Lab Activities • Oral Presentation • Projects • Quizzes • Written examination

Representative Texts

Textbooks such as the following are appropriate:

Formatting Style	APA

Textbooks	
	1. Smith, D. M... *Engineering Computation with MATLAB*, 3 ed. Addison Wesley/Pearson, 2013
	2. Joseph C. Musto, William E. Howard, Richard R. Williams. *Engineering Computations: An Introduction Using MATLAB and Excel*, 2 ed. McGraw-Hill, 2021
Manuals	
	1. Campbell, M.. Introduction to Octave and MATLAB for Math, Science, and Engineering Students, Campbell, 01-01-2018
Periodicals	
You have no periodicals defined.	
Software	
	1. ZEMAX. https://www.zemax.com/products/opticstudio, OpticStudio ed. Zemax OPticStudio is a commercially used optical design software.
	2. ZEMABuilder. https://www.zemax.com/products/opticsbuilder, OpticsBuilder ed. Commerical optical software to build optical systems
	3. ZEMAX. https://www.zemax.com/products/opticsviewer, OpticsViewer ed. Commercial software to view and model optical system performance
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? 1. CA in Photonics and Laser Technology 2. CA in Advanced Photonics and Laser Technology

General Education/Degree/Transfer Course

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By Ramki Kalyanaraman

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	
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: Smith, D. M... Engineering Computation with MATLAB, 3 ed.Addison Wesley/Pearson, 2013 Joseph C. Musto, William E. Howard, Richard R. Williams. Engineering Computations: An Introduction Using MATLAB and Excel, 2 ed.McGraw-Hill, 2021 Possible manuals include: Campbell, M.. Introduction to Octave and MATLAB for Math, Science, and Engineering Students, Campbell, 01-01-2018 Possible software includes: ZEMAX. https://www.zemax.com/products/opticstudio, OpticStudio ed. Zemax OPticStudio is a commercially used optical design software. ZEMABuilder. https://www.zemax.com/products/opticsbuilder, OpticsBuilder ed. Commerical optical software to build optical systems ZEMAX. https://www.zemax.com/products/opticsviewer, OpticsViewer ed. Commercial software to view and model optical system performance
Methods of Evaluation of Student Performance:	1. Biweekly laboratory report submitted online 2. Biweekly Homework submitted online 3. Monthly design project report submitted online
How are you ensuring that students with disabilities can access your course in accordance with Section 508?	Students will have access to all material on-line or for download to use offline - All video lessons also have caption/subtitle - All video lessons also have associated printable files.

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 lessons content will be delivered 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. None of the above
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	D - Possible Occupational
CB11 California Classification Codes	Y - Credit Course
CB21 Levels Below Transfer	Y = Not Applicable
CB23 Funding Agency	A = Fully Economic Development funds

Category	
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	D - Possible 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