



SACRAMENTO  
STATE

# Course Change Proposal Form A



<b>Academic Group (College):</b> ECS	<b>Academic Organization (Department):</b> EEE	<b>Date:</b> 10/16/2008
<b>Type of Course Proposal:</b> New <input checked="" type="checkbox"/> Change <input type="checkbox"/> Deletion <input type="checkbox"/>	<b>Department Chair:</b> Suresh Vadhva	<b>Submitted by:</b> Russ Tatro
<b>Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></b>	<b>For Catalog Copy: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></b> <b>CCE (Extension): Yes <input type="checkbox"/> No <input type="checkbox"/></b>	<b>Semester Effective:</b> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> 2009

This course replaces experimental course Subject Area (prefix) and Catalog Nbr (course number):

**Change from:**

<b>Subject Area (prefix) &amp; Catalog Nbr (course no.):</b>	<b>Title:</b>	<b>Units:</b>
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**Change to:**

<b>Subject Area (prefix) &amp; Catalog Nbr (course no.):</b> EEE 265	<b>Title: Optoelectronic Engineering</b>	<b>Units:</b> 4
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**JUSTIFICATION:**

This course will introduce graduate students to the field of optical communication and optoelectronic devices. The existing graduate optoelectronic courses such as EE 215 Lasers and EEE 267 Fiber Optic Communications are very narrow in focus and concentrate on historic telecommunication uses of optical systems. This proposed course will introduce optical sensors, use of optical techniques in instrumentation and photonic energy devices in addition to an overview of telecommunication devices using photonic systems. This mix of topics better reflects the current issues graduate students may encounter upon graduation. This graduate level course also requires a laboratory which requires hands-on activities in advanced optical design, optical device use and optical system analysis.

**NEW COURSE DESCRIPTION: (Not to exceed 80 words, and language should conform to catalog copy. See <http://www.csus.edu/acaf/univmanual/crspsl.htm> - Guidelines for Catalog Course Description)**

Generation, propagation and detection of light. Fresnel equations, Snell's law, diffraction, polarization and interference. Operating principles of LEDs, lasers, photodiodes, optical fibers, and photovoltaic devices. Introduction to optical communications systems, and optical instrumentation. EEE 265 and EEE 165 may not be both taken for graduate credit. Units: 4.0.

**Note:**

**Prerequisite: Graduate standing or instructor permission.**

**Enforced at Registration: Yes No**

**Corequisite:**

**Enforced at Registration: Yes No**

**CAN (California Articulation Number):**

**Graded: Letter  Credit/No Credit**

**Instructor Approval Required? Yes  No**

**Course Classification (e.g., lecture, lab, seminar, discussion):**  
C4/16

**Title for CMS (not more than 30 characters)**  
Optoelectronic Engineering

**Cross Listed?**  
Yes  No

**If yes, do they meet together and fulfill the same requirement, and what is the other course.**

**How Many Times Can This Course be Taken for Credit?   1**

**Can the course be taken for Credit more than once during the same term? Yes  No**

**FOR NEW COURSE PROPOSALS OR SUBSTANTIVE CHANGES ONLY:**

**Description of the Expected Learning Outcomes:** Describe outcomes using the following format: "Students will be able to: 1), 2), etc." See the example at <http://www.csus.edu/acaf/example.htm>

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

- 1) Design and implement optoelectronic communication systems including use of light emitters, fiber optical waveguides and photodetectors.
- 2) Estimate the performance of photovoltaic systems.
- 3) Compose research papers on optoelectronic topics.
- 4) Use modern simulation software (for example OptSim by RSoft) applicable to optoelectronic systems.
- 5) Organize an optoelectronic project and complete that work in design teams.

\*\*Attach a list of the required/recommended course readings and activities [Note: it is understood that these are updated and modified as needed by the instructor(s).] This attachment should be forwarded only to your Dean's office, not Academic Affairs.

**Assessment Strategies:** A description of the assessment strategies (e.g., portfolios, examinations, performances, pre-and post-tests, conferences with students, student papers) which will be used by the instructor to determine the extent to which students have achieved the learning outcomes noted above:

- Two Midterm exams (20% each for a total of 40% of the total grade)
- Approximately 10 laboratory reports (25% of the total grade)
- Research paper on optoelectronic topic (10%)
- Final exam (25%)

For whom is this course being developed?

Majors in the Dept  Majors of other Depts \_\_\_ Minors in the Dept \_\_\_ General Education \_\_\_ Other \_\_\_

Is this course required in a degree program (major, minor, graduate degree, certificate)? Yes \_\_\_ No

If yes, identify program(s):

Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer facilities, faculty, etc.)? Yes \_\_\_ No

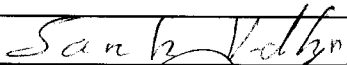
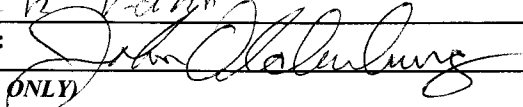
If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any). None

*The Department Chair's signature below indicates that affected programs have been sent a copy of this proposal form.*

**Approvals:** If proposed change, new course or deletion is approved, sign and date below. If not approved, forward without signing to the next reviewing authority, and attach an explanatory memorandum to the original copy.

**Signatures:**

	Date
Department Chair: 	11/20/2008
College Dean or Associate Dean: 	11/21/08
CPSP (for school personnel courses ONLY)	
Associate Vice President and Dean for Academic Programs	

**Distribution:** Academic Affairs (original), Department Chair and College Dean. Dean's office to send original after approval to Academic Affairs, at mail zip 6016. An electronic copy must also be sent.

Recommendations as per EEE Curriculum Committee  
11/07/2008

EEE 265:

Creation of new graduate level course in optoelectronics.

**Rationale:**

Graduate students are requesting a detailed overview course in optics and optoelectronics similar to the EEE 165 course offered to undergraduates. This course will complement other initiatives such as the bio-instrumentation course series by discussing the mechanisms and principles of various optoelectronic devices used optical sensors. This topic coverage better reflects the current optical engineering issues the students may encounter after graduation.

There are two main differences between the undergraduate course EEE 165 and the graduate course EEE 265. First, the graduate version will demand the student's ability to handle higher frequency content in the mid 100 MHz range. Associated with this higher mastery level is student proficiency in modern communication systems such as modulation techniques, distributed parameter model analysis, and digital signal processing methods. Exam questions will reflect a more advanced mastery of the optical topics. Thus the homework and exam questions will be more comprehensive in nature as appropriate to a graduate level course. Both the undergraduate and graduate courses require a term paper that researches the peer-reviewed literature on an optical topic. The graduate term paper will be more focused on recent advances in the optical field and require greater student ability to integrate the various research papers into a well "compared and contrasted" topic.

The second main difference between the undergraduate and graduate courses is the requirement of a laboratory. The undergraduate course does have an optional laboratory with about half the EEE 165 students taking this elective lab (EEE 167). The graduate version will have a required laboratory. The graduate students will be introduced to a few of the basic optical topics similar to the EEE 167 course. But the graduate version will quickly move on to advanced modulation as simulated in the OptSim software. They will create a simulated communication system and examine the advanced parameters involved in such a system (3 weeks). Then the graduate students will build such a system in hardware and verify the real world measurements (3 weeks). Each laboratory will require a report that meets the current IEEE standards appropriate to published research papers.

EEE 265 Introduction to Optoelectronic Engineering  
ABET Syllabus

**Elective Course**

**2008 – 2010 Catalog Data:** EEE 265. Optoelectronic Engineering. Generation, propagation and detection of light. Fresnel equations, Snells law, diffraction, polarization and interference. Operating principles of LEDs, lasers, photodiodes and optical fibers. Introduction to optical communications systems, photovoltaic devices, and optical instrumentation.

**Prerequisite:** Graduate Standing. 4 units.

**Text:** S.O. Kasap, Optoelectronics and Photonics: Principles and Practices, Prentice Hall, is required.

**Reference:** Wilson, J. and Hawkes, J., Optoelectronics: An Introduction, Prentice Hall, 3<sup>rd</sup> Edition, 1998. Verdeyen, Joseph T., Laser Electronics, Prentice Hall, 3<sup>rd</sup> Edition, 2000.

**Course Objectives:**

1. Provide an overview of the principles, design, and applications of optoelectronic devices, optical sensors and optical communication systems.
2. Reinforce research methodology by each student picking a relevant topic in the area of electro-optical engineering design, and writing a research paper.

**Prerequisites by Topic:**

1. Maxwell's equations and transverse electromagnetic waves. From: EEE 161
2. Time domain and frequency domain analysis of linear continuous time and discrete time systems. From: EEE 180 and EEE 185

**Topics Covered/Class Schedule/Evaluation:**

1. Introduction and wave theory of light, Fresnel equations, Snell's law, Ray optics (2 weeks).
2. Slab waveguides, mode structure, fiber optics (2 weeks).
3. Detection of optical radiation; photoeffect, photoconductive and semiconductor detectors; noise, digital transmission, coherent detection (2 weeks).
4. Planck's law, optical radiation, gain and lineshape, multilevel systems, LED's and lasers, Fabry-Perot cavities, gain saturation, laser output power (2 weeks).
5. Semiconductor lasers/modulation (2 weeks).
6. Electro-optic effect, phase modulators, interfero-metric modulators, acousto-optic modulators (1 week).
7. Sensors: intensity, phase, frequency, wavelength and polarization modulation (1.5 weeks).
8. Photovoltaic devices (1 week).
9. Exams – 2 midterms, 1 final exam (1.5 weeks).

**Course Outline:**

<i>Week</i>	<i>Topic</i>	<i>Homework (H)</i>	<i>Exam (E)</i>
1	Introduction, Wave nature of light, Refractive index		
2	Snell's Law, Fresnel's equations, Diffraction	H	
3	Slab waveguide, Dispersion, Numerical aperture		
4	Optical Fibers, Scattering and attenuation	H	
5	Semiconductor concept review		
6	LEDs	H	E
7	Stimulated emission, Lasers	H	
8	Photodetectors		
9	Noise in photodetectors	H	E
10	Photovoltaic Devices	H	
11	Polarization		
12	Birefringence	H	
13	Optical Sensors		
14	Fiber Optic System design	H	
15	Review and wrap-up		
16	Exam Week – Final Exam		E

**Evaluation:**

1. Homework assignments are an excellent way to prepare for the exams. They are assigned by chapter. Students are encouraged to form study groups.
2. Using the course website(<http://www.csus.edu/indiv/t/tatror/>), students can assess their learning any time with the homework solutions and use the appropriate tutorial material.
3. Homework (0%), research paper (10%), two mid-term exams (20%, 20%), laboratory reports (25%) and a final exam (25%). Exams are given during the lecture period. The final exam is comprehensive.

**Contribution of Course to the Professional Education Component:**

- Homework assignments include practical devices and contain design requirements. The fiber optic system design requires the student to investigate real device specifications, system requirements and cost considerations in their solution to the design specifications.
- The research paper reinforces the student's ability to search the literature on a specific topic. They must then summarize their findings in written form. The research papers are published on the course website for other students review and information.
- Science and Design Content Distribution: Science – 1 units or 33%; Design – 2 units or 67%.

**Relationship of Course to Program Outcomes:**

- #3. Problem Solving: The course applies integral calculus and differential equations to the solution of electromagnetic design and analysis problems.
- #4. Knowledge of core EEE topics: The course adds optoelectronic effects to the analysis and design to the fundamental concepts of electricity, magnetism, and circuit analysis.
- #11. Written communications: All students are required to prepare a research paper which follows the IEEE guidelines.

**Lab Outline:**

<i>Week</i>	<i>Topic</i>	<i>Report (R)</i>
1	Introduction and Optical laboratory safety	
2	Diffraction of light	R
3	Polarization of light	R
4	Photovoltaic devices	R
5 & 6	LED Characterization	R
7	Liquid Crystal Displays	R
8	Linear attenuation in optical fibers	R
9	Photodetector characterization	R
10, 11, 12	Fiber Optic Communication Link – System Design	R
13, 14, 15	Fiber Optic Communication Link – Electrical characterization	R
16	Exam Week	

**Evaluation:**

25% of the course grade is determined by the laboratory reports. Reports are due one week after the experiment is completed.

**Contribution of Course to the Professional Education Component:**

- Laboratory projects provide practical experience with electro-optical devices. The students knowledge of engineering design is reinforced by the use of the test and measurement equipment.
- Science and Design Content Distribution: Science – 20%; Design – 80%.

**Relationship of Course to Program Outcomes:**

- #5. Depth in one EEE area: The laboratory provides depth in communication engineering.
- #7. Use of contemporary tools for analysis and design: This course utilizes the Optisim by RSoft software to simulate a modern optical communication system.
- #8. Experimental work: This course gives the student hands-on experience with optical components and measuring instrumentation similar to that used in industry.
- #10. Teamwork. The students work together in teams to complete the experiment and collect the experimental data.
- #11. Written communications: All students are required to prepare a formal written laboratory report. This helps the student develop communication skills.