



SACRAMENTO
STATE

Course Change Proposal Form A



Academic Group (College): Engineering & Computer Science	Academic Organization (Department): Electrical & Electronic Engineering	Date: 10/6/2008
Type of Course Proposal: New ___ Change <u>X</u> Deletion ___	Department Chair: Dr. Suresh Vadhva	Submitted by: Dr. Suresh Vadhva
Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes <u>X</u> No ___	For Catalog Copy: Yes <u>X</u> No ___ CCE (Extension): Yes ___ No ___	Semester Effective: Fall ___ Spring <u>X</u> , 2009 ___

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

Subject Area (prefix) & Catalog Nbr (course no.): EEE 166	Title: Physical Electronics	Units: 3
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Change to:

Subject Area (prefix) & Catalog Nbr (course no.):	Title:	Units:
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JUSTIFICATION:

Prerequisite change only. From EEE 117, EEE117L to EEE 108. 166 is an advanced physical electronics course where the physical behavior of semiconductor devices is discussed. The terminal behavior of devices within specific circuit configurations is not discussed. 108 is a course where behavior of semiconductor elements is discussed from the terminal point of view, where the devices are placed under specific DC and AC conditions.

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)

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Note:

Prerequisite: EEE 108
Enforced at Registration: Yes X No ___

Corequisite:
Enforced at Registration: Yes ___ No X

CAN (California Articulation Number):

Graded: Letter X Credit/No Credit ___ **Instructor Approval Required? Yes ___ No X**

Course Classification (e.g., lecture, lab, seminar, discussion):
C04 **Title for CMS (not more than 30 characters):**
Physical Electronics

Cross Listed? Yes ___ No <u>X</u>	If yes, do they meet together and fulfill the same requirement, and what is the other course.
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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 X

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>

****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:

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 ___

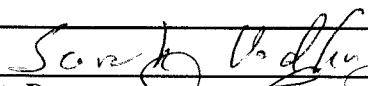
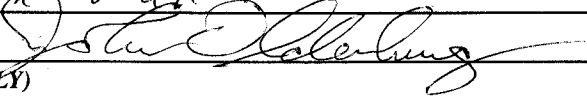
If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any). _____

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:

Signatures:	Date
Department Chair: 	11/14/2008
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.

EEE 166 PHYSICAL ELECTRONICS

Required Course

2008 – 2010 Catalog Data: EEE 166. Physical Electronics. Semiconductor physics, atomic models and crystal structures. Quantum theory, energy bands, motion of charge carriers, minority/majority carrier profiles and pn junctions. Manufacturing processes for and operating characteristics of diodes, bipolar transistors and field-effect devices. Prerequisite: EEE 108. 3 units.

Textbook: Donald Neamen, Semiconductor Physics and Devices, Second Edition, 2002, McGraw Hill

Course Objectives:

1. To provide students with a basic understanding of semiconductor devices, including derivation of the modeling equations, which govern the electrical properties.
2. To integrate the knowledge learned from the prerequisites for understanding the physical properties of semiconductor devices.
3. To apply device physics knowledge to common and widely used devices, e.g. MOSFETs.

Prerequisites by Topic:

Courses relevant to Device Physics include: One semester of chemistry (Chem 1A), two semesters of physics including electricity and magnetism (Phys 11A, Phys 11C), Differential Equations (Math 45), and Basic Circuit Analysis (Engr 17).

Topics Covered/Evaluation:

1. Crystal structure for semiconductors. (0.5 weeks)
2. Introduction to quantum mechanics including Kronig-Penney model and resulting energy versus k curves. (1 week)
3. Energy band diagrams from k -space to real space (x). (0.5 week)
4. Electrons and holes, Fermi distribution and density of states. (1 week)
5. Equilibrium of intrinsic and extrinsic semiconductors. (1 week)
6. Drift current. (1 week)
7. Diffusion current. (1 week)
8. Excess carriers and recombination. (1 week)
9. Transport and Poisson equations. (1.5 weeks)
10. P/N junctions. (2 weeks)
11. Ohmic and Schottky contacts. (0.5 weeks)
12. MOSFETs. (2.5 weeks)
13. Bipolar junction devices. (1.5 weeks)

Contribution of Course to the Professional Education Component:

Homework and tests are used for several purposes:

- As a tool to reinforce the use of material found in prerequisite courses.
- To introduce students to current devices prominent in our local industry.
- To enhance students' ability to model the properties of commonly used devices such as MOSFETs, and new research devices such as memories based on quantum mechanics and optical devices.
- Science and Design Content Distribution: Science – 3 units or 100%

Relationship of Course to Program Outcomes:

- #1 and #3. Knowledge of mathematics and problem solving: Applications of differential equations for the solution of device physics problems including solutions to Poisson's equation, continuity equation, and current density equation.
- #6. Knowledge of probability, statistics and applications: Application of Fermi Dirac statistics as it relates to the occupation probability of electrons and holes in the conduction and valence band. Probability of recombination using the Shockley-Read-Hall model.

Course Coordinator: **Cynthia Colinge**

Date: **November 10, 2008**

Previous
Version

EEE 166 PHYSICAL ELECTRONICS

Required Course

2006 – 2008 Catalog Data: EEE 166. Physical Electronics. Semiconductor physics, atomic models and crystal structures. Quantum theory, energy bands, motion of charge carriers, minority/majority carrier profiles and pn junctions. Manufacturing processes for and operating characteristics of diodes, bipolar transistors and field-effect devices. Prerequisite: EEE 117, EEE 117L either may be taken concurrently. 3 units.

Textbook: Donald Neamen, Semiconductor Physics and Devices, Second Edition, 2002, McGraw Hill

Course Objectives:

1. To provide students with a basic understanding of semiconductor devices, including derivation of the modeling equations, which govern the electrical properties.
2. To integrate the knowledge learned from the prerequisites for understanding the physical properties of semiconductor devices.
3. To apply device physics knowledge to common and widely used devices, e.g. MOSFETs.

Prerequisites by Topic:

Courses relevant to Device Physics include: One semester of chemistry, two semesters of physics including electricity and magnetism, Differential Equations, and Basic Circuit Analysis.

Topics Covered/Evaluation:

1. Crystal structure for semiconductors. (0.5 weeks)
2. Introduction to quantum mechanics including Kronig-Penney model and resulting energy versus k curves. (1 week)
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Contribution of Course to the Professional Education Component:

Homework and tests are used for several purposes:

- As a tool to reinforce the use of material found in prerequisite courses.
- To introduce students to current devices prominent in our local industry.
- To enhance students' ability to model the properties of commonly used devices such as MOSFETs, and new research devices such as memories based on quantum mechanics and optical devices.
- To enhance the students understanding of follow-on courses such as electronic circuit design (EEE 108 and EEE 109).
- Science and Design Content Distribution: Science – 3 units or 100%

Relationship of Course to Program Outcomes:

- #1 and #3. Knowledge of mathematics and problem solving: Applications of differential equations for the solution of device physics problems including solutions to Poisson's equation, continuity equation, and current density equation.
- #6. Knowledge of probability, statistics and applications: Application of Fermi Dirac statistics as it relates to the occupation probability of electrons and holes in the conduction and valence band. Probability of recombination using the Shockley-Read-Hall model.

Course Coordinator: **Cynthia Colinge**

Date: **May 15, 2003**