



SACRAMENTO
STATE

Course Change Proposal Form A



Academic Group (<i>College</i>): ECS	Academic Organization (<i>Department</i>): EEE	Date: 09/18/2006
Type of Course Proposal: New ___ Change <u>X</u> Deletion ___	Department Chair: Dr. Suresh Vadhva	Submitted by: Dr. Perry Heedley
Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes ___ No <u>X</u>	For Catalog Copy: Yes <u>X</u> No ___ CCE: Yes ___ No <u>X</u>	Semester Effective: Fall ___ Spring <u>X</u> , 20_07__

This course replaces experimental course Subject Area (<i>prefix</i>) and Catalog Number (<i>course number</i>):	EEE 296L
This Catalog Number (<i>course number</i>) is being replaced:	

Change from:

Subject Area (<i>prefix</i>) & Catalog No. (<i>course no.</i>): EEE 296L	Title: Advanced Analog & Mixed Signal Integrated Circuit Design	Units: 3
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Change to:

Subject Area (<i>prefix</i>) & Catalog No. (<i>course no.</i>): EEE 231	Title: Advanced Analog & Mixed Signal Integrated Circuit Design	Units: 3
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JUSTIFICATION:

This is a change in course number to make EEE296 L permanent, and to align with the EEE graduate program microelectronic design area designations. A minor adjustment in course content is also being made based on experience gained teaching EEE 296L as an experimental class.

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)

A companion course to EEE 230, this course covers additional topics important in analog and mixed-signal integrated circuit design. Topics include traditional issues such as device matching and analog layout techniques, as well as important building blocks such as bandgap references and bias circuits. Also included are current-mode techniques such as high-speed current-mode logic (CML), and an introduction to noise in integrated circuits. Circuit and layout projects are assigned using CAD software.

Note:

Prerequisite: EEE 230 or consent of the instructor

Corequisite:

CAN (California Articulation Number):

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

Course Classification (*e.g., lecture, lab, seminar, discussion*):
C5 Lecture Title for SIS+/CMS (not more than 30 characters)
Adv Analog+Mixed Sig IC Dsgn

Cross Listed? Yes ___ No X 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? ___ Once ___

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>

Students will be able to:

- 1) Understand matching requirements for analog circuits and design for matching
- 2) Understand and use analog & mixed-signal layout techniques
- 3) Analyze and design supply & temperature independent biasing circuits
- 4) Analyze and design Current Mode Logic (CML) circuits
- 5) Understand and analyze noise in analog & mixed-signal circuits

**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:

Exams will include midterm and final exams. Homeworks will also be assigned, as will circuit design and analog & mixed-signal layout projects using CAD tools such as PSpice and LEdit.

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:

	Date
Department Chair: <i>Sue b Uedh-</i>	<i>11/21/06</i>
College Dean or Associate Dean: <i>[Signature]</i>	<i>11/21/06</i>
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 231 – Advanced Analog & Mixed-Signal Integrated Circuit Design

Course Description :

A companion course to EEE 230, this course covers additional topics important in analog and mixed-signal integrated circuit design. Topics include traditional issues such as device matching and analog layout techniques, as well as important building blocks such as bandgap references and bias circuits. Also included are current-mode techniques such as high-speed current-mode logic (CML), and an introduction to noise in integrated circuits. Circuit and layout projects are assigned using CAD software.

Instructors : Perry L Heedley and Thomas W Matthews

Textbook :

“Design of Analog CMOS Integrated Circuits” by Behzad Razavi, McGraw Hill 2001

Additional References :

“Analysis and Design of Analog Integrated Circuits” by Paul Gray and Robert Meyer, John Wiley & Sons, Inc.

“Analog Integrated Circuit Design” by David Johns and Ken Martin, John Wiley & Sons, Inc. 1997”

Projects : Projects will be assigned to reinforce and expand upon classroom discussions on device matching and analog & mixed-signal IC layout techniques.

Grading : Exams (50%), Projects (25%), Homework (15%), Classroom participation (10%)

Lecture Schedule

<u>Week</u>	<u>Topic</u>
1-3	Course introduction, Matching: area dependence, differential amplifiers, current mirrors, passive devices
4-5	Analog layout techniques: floorplanning, centroding, mirror vs step symmetry, PLI, neighborhood matching
6-7	Supply & temperature independent biasing, PTAT and constant-gm bias circuits
8	Review, Mid-Term Exam
9-10	Bandgap references, bias & reference distribution
11-12	Current-mode techniques, CML logic
13-14	Noise in integrated circuits
15	Testing of mixed-signal circuits, Review for Final Exam