



SACRAMENTO  
STATE

# Course Change Proposal Form A



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

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

**Change from:**

<b>Subject Area (prefix) &amp; Catalog No. (course no.):</b> EEE 296M	<b>Title:</b> Key Mixed-Signal Integrated Circuit Building Blocks	<b>Units:</b> 3
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**Change to:**

<b>Subject Area (prefix) &amp; Catalog No. (course no.):</b> EEE 232	<b>Title:</b> Key Mixed-Signal Integrated Circuit Building Blocks	<b>Units:</b> 3
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**JUSTIFICATION:**

This is a change in course number to make EEE296 M permanent, and to align it with the EEE graduate program courses in the area of microelectronic design. A minor adjustment in course content is also being made based on experience gained teaching EEE 296M 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)

This course covers the key mixed-signal integrated circuit building blocks most often used in modern ICs. Topics covered include data converter fundamentals, comparators, and important circuit architectures for Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs) and Phase-Locked Loops (PLLs).

**Note:**

**Prerequisite:** EEE 230 or consent of instructor

**Corequisite:**

**CAN (California Articulation Number):**

<b>Graded: Letter <u>X</u> Credit/No Credit ___</b>	<b>Instructor Approval Required? Yes ___ No <u>X</u></b>
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<b>Course Classification (e.g., lecture, lab, seminar, discussion):</b> C5 Lecture	<b>Title for SIS+/CMS (not more than 30 characters)</b> Key Mixed Sig IC Bld Blks
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<b>Cross Listed?</b> Yes ___ No <u>X</u>	<b>If yes, do they meet together and fulfill the same requirement, and what is the other course.</b>
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**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 data converter fundamentals such as quantization noise and linearity
- 2) Analyze and design comparators
- 3) Analyze and design Analog-to-Digital Converters (ADCs)
- 4) Analyze and design Digital-to-Analog Converters (DACs)
- 5) Analyze and design Phase-Locked Loops (PLLs)

\*\*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 projects using CAD tools such as PSpice.**

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>Samh North</i>	<i>11/21/2006</i>
College Dean or Associate Dean: <i>JF</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 232 – Key Mixed-Signal Integrated Circuit Building Blocks

### Course Description :

This course covers the key mixed-signal integrated circuit building blocks most often used in modern ICs. Topics covered include data converter fundamentals, comparators, and important circuit architectures for Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs) and Phase-Locked Loops (PLLs).

Instructors : Perry L Heedley and Thomas W Matthews

### Textbook :

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

### Additional References :

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

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

Projects : Projects will be assigned to reinforce and expand upon classroom discussions on comparators, data converters and phase-locked loops.

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

## Lecture Schedule

<u>Week</u>	<u>Topics</u>
1-2	Course introduction, data converter fundamentals, quantization noise, differential and integral non-linearity
3	Comparators, open-loop vs latching architectures, hysteresis
4-7	Analog-to-Digital Converters (ADCs): successive-approximation, dual-slope, Flash architectures, folding and interpolation, Pipelined and algorithmic architectures
8	Review, Mid-Term Exam
9-11	Digital-to-Analog Converters (DACs): current steered, charge-redistribution, dynamic element matching and calibration
12-14	Phase-Locked Loops (PLLs): basic concepts, linearized loop analysis, phase detectors and charge pumps, ring oscillator and LC tank VCOs
15	High-speed data communications, Review for Final Exam