SACRAMENTO STATE

Course Change Proposal
Form A

Academic Group (*College*): ECS	Academic Organization (*Department*): EEE	Date: 02/14/2008
Type of Course Proposal: New _x__ Change ___ Deletion ___	Department Chair: Suresh Vadhva	Submitted by: Warren D. Smith
Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes ___ No _x__	For Catalog Copy: Yes _x__ No ___ CCE (*Extension*): Yes ___ No ___	Semester Effective: Fall _x__ Spring ___, 2008

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

Change from:

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

Change to:

Subject Area (*prefix*) & Catalog Nbr (*course no.*):	Title:	Units:
EEE 122	Applied Digital Signal Processing	3

JUSTIFICATION:

This course is a course in an elective sequence on instrumentation design with emphasis on biomedical instrumentation. This course will prepare students for further work in signal processing, instrumentation, and biomedical applications.

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

Application of digital signal processing to biomedical signals. Origin and characteristics of biomedical signals and contaminations. Preparation of biomedical signals for processing, including sensors, amplification, filtering, sampling, and quantization. Time-domain processing, including peak and zero-crossing detection, time interval measurement, peak height, and moving average estimates of mean and root mean square value. Frequency domain processing, including filtering to separate biomedical signal components and spectrum estimation. Joint time-frequency analysis. Prerequisite: EEE 117, EEE 180. 3 units.

Note:

Prerequisite: EEE 117, EEE 180.
Enforced at Registration: Yes___ No_x__

Corequisite:
Enforced at Registration: Yes___ No___

CAN (California Articulation Number):

Graded: Letter __x___ Credit/No Credit____	Instructor Approval Required? Yes___ No_x__
Course Classification (*e.g., lecture, lab, seminar, discussion*): C4	Title for CMS (not more than 30 characters) Appl. Digital Signal Process.
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? ___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. Identify signal processing needs in biomedical applications.
2. Acquire knowledge of various signal processing algorithms suitable for biomedical applications.
3. Design signal processing algorithms to meet specific biomedical needs.
4. Assess the performance and usefulness of signal processing algorithms.

**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:

Three written project reports.
Oral project report

For whom is this course being developed?
Majors in the Dept _x__ 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 _x__
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 __x__
If yes, attach a description of resources needed and verify that resources are available.
Signal processing resources are already in place within the EEE Department.

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: Steven K. Thiel	3/27/2008
College Dean or Associate Dean: John Kolenbrander	4/16/08
CPSP *(for school personnel courses ONLY)*	
Associate Vice President and Dean for Academic Programs CONDITIONAL APPROVAL 4/18/2008	

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 122 Applied Digital Signal Processing

EEE Elective

2008 – 2010 Catalog Data: EEE 122. Applied Digital Signal Processing. Application of digital signal processing to biomedical signals. Origin and characteristics of biomedical signals and contaminations. Preparation of biomedical signals for processing, including sensors, amplification, filtering, sampling, and quantization. Time-domain processing, including peak and zero-crossing detection, time interval measurement, peak height, and moving average estimates of mean and root mean square value. Frequency domain processing, including filtering to separate biomedical signal components and spectrum estimation. Joint time-frequency analysis. Prerequisite: EEE 117, EEE 180. 3 units.

Text: Bruce, Eugene N., *Biomedical Signal Processing and Signal Modeling*, Wiley, 2001. ISBN: 0-471-34540-7.

Course Goals:

1. To build upon the fundamental electrical engineering analysis and design backgrounds provided by the EEE core and elective courses.
2. To provide the student with practical engineering knowledge about biomedical applications of digital signal processing.
3. To provide the student with guided experience in designing and evaluating digital signal processing algorithms to extract desired information from biomedical signals.

Prerequisites by Topic:

1. Understanding of signals and systems, including both time and frequency domain techniques.
2. Knowledge of proper use of standard test and measurement equipment.
3. General knowledge of a structured programming language (e.g., MATLAB, C++).

Topics Covered/Course Outline/Evaluation:

Week **Lecture Topic**

1. Introduction. Overview of biomedical signals.
2. Begin Project #1: Biomedical signal acquisition. Biomedical signal origins, types, characteristics, contaminations. Simulation of biomedical signals and contaminations.
3. Information we want from biomedical signals.
4. Preparing a biomedical signal for processing. Sensor, amplification, filtering, sampling, quantizing.
5. Electrocardiogram (ECG) acquisition. Project #1 report due.
6. Begin Project #2: Time-domain processing of biomedical signals. Time-domain processing of biomedical signals.
7. Peak detection, zero-crossing, interval (e.g., BBHR).
8. Maximum, minimum, peak-to-peak, average, root mean square (e.g., EMG).
9. Averaging to improve signal-to-noise ratio.
10. Example: mid-latency auditory evoked response. Project #2 report due.
11. Begin Project #3: Frequency domain processing of biomedical signals. Frequency domain processing of biomedical signals.
12. Example: separation of heart and respiratory signals from PVDF sensor signal.
13. Example: EMG spectrum to determine muscle fatigue.
14. Joint time-frequency analysis (JTFA) of biomedical signals.
15. Example: EEG JTFA to monitor depth of anesthesia.
16. Project #3 report due.

Evaluation:

Two written project reports: 33% each, for a total of 67%.
One final combined written and oral project report: 33%.

Science and Design Content Distribution:

Science – 1 units or 33%, Design – 2 units or 67%.

Contribution of Course to the Professional Education Component:

Examples introduce students to biomedical applications of digital signal processing.
Design projects include practical signal processing use and evaluation.

Relationship of Course to Program Outcomes:

1. (b) An ability to design and conduct experiments, as well as to analyze and interpret the data.
2. (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. (g) An ability to communicate effectively.
4. (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Coordinator: Warren D. Smith **Date:** February 14, 2008