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UNIVERSITY OF KENTUCKY
APPLICATION FOR CHANGE IN EXISTING COURSE: MAJOR & MINOR

MAR 26 2007

OFFICE OF THE SENATE COUNCIL

1. Submitted by College of Engineering Date 9-2006

   Department/Division offering course Electrical and Computer Engineering

2. Changes proposed:
   (a) Present prefix & number EE422G Proposed prefix & number No change

   (b) Present Title Signals and Systems II

   New Title Signals and Systems Laboratory

   (c) If course title is changed and exceeds 24 characters (Including spaces), include a sensible title (not to exceed 24 characters) for use on transcripts:
   Signals & Systems Lab

   (d) Present credits: 3 Proposed credits: 2

   (e) Current lecture: laboratory ratio 3:0 Proposed: 1:1

   (f) Effective Date of Change: (Semester & Year) 2007 Fall

3. To be Cross-listed as: _____ _____
   Prefix and Number Signature: Department Chair

4. Proposed change in Bulletin description:
   (a) Present description (including prerequisite(s):
   A continuation of the analysis of signals and linear systems with an emphasis on feedback and discrete-time systems. Topics include the Laplace and Z-transforms, frequency domain modeling techniques, feedback principles, state variables, sampling and digital filter design. Prereq: EE 421G.

   (b) New description:
   Lectures and laboratory exercises on signal and systems modeling. Topics include noise models and analysis, filter design, modulation techniques, sampling, discrete Fourier Transforms, State Variable Models, and feedback design with an emphasis on using computer software for analysis and simulation.

   (c) Prerequisite(s) for course as changed: EE 421G, MA320

5. What has prompted this proposal?
   With proposed changes in EE421, and previous changes in making MA320 Probability theory required 2 years ago, this course can focus on implementing systems, which is becoming a critical/necessary entry-level skill in many of the industries that hire our students.

6. If there are to be significant changes in the content or teaching objectives of this course, indicate changes:
   Application of Laplace and intro to discrete signals and systems has been removed (now included in EE421G), State Variable Models have been added with an emphasis on implementing systems based on the concepts presented in EE421G and the lecture component of EE422G.

7. What other departments could be affected by the proposed change?
   (none) The course is almost exclusively taken by Electrical Engineering majors

8. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky? X Yes ☐ No

9. Will changing this course change the degree requirements in one or more programs? ☐ Yes X No
   If yes, please attach an explanation of the change. (NOTE – If "yes," program change form must also be submitted.)

10. Is this course currently included in the University Studies Program? ☐ Yes X No
    If yes, please attach correspondence indicating concurrence of the University Studies Committee.

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11. If the course is 400G or 500 level, include syllabi or course statement showing differentiation for undergraduate and graduate students in assignments, grading criteria, and grading scales. X Check here if 400G-500.

12. Is this a minor change? ☐ Yes X No
(NOTE: See the description on this form of what constitutes a minor change. Minor changes are sent directly from the Dean of the College to the Chair of the Senate Council. If the latter deems the change not to be minor, it will be sent to the appropriate Council for normal processing.)

13. Within the Department, who should be consulted for further information on the proposed course change?

Name: Kevin D. Donohue Phone Extension: 7-4004

Signatures of Approval:

4/20/06 18 in favor 0 against	
Date of Approval by Department Faculty	Reported by Department Chair
12/14/06	
Date of Approval by College Faculty	Reported by College Dean
March 20, 2007	
*Date of Approval by Undergraduate Council	Reported by Undergraduate Council Chair
Approved by Graduate Council	2/23/07
*Date of Approval by Graduate Council	Reported by Graduate Council Chair
*Date of Approval by Health Care Colleges Council (HCCC)	Reported by HCCC Chair
*Date of Approval by Senate Council	Reported by Senate Council Office
*Date of Approval by University Senate	Reported by Senate Council Office

*If applicable, as provided by the Rules of the University Senate.

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The Minor Change route for courses is provided as a mechanism to make changes in existing courses and is limited to one or more of the following:

a. change in number within the same hundred series;
b. editorial change in description which does not imply change in content or emphasis;
c. editorial change in title which does not imply change in content or emphasis;
d. change in prerequisite which does not imply change in content or emphasis;
e. cross-listing of courses under conditions set forth in item 3.0;
f. correction of typographical errors. [University Senate Rules, Section III - 3.1]

EE 422G: Signals & Systems Laboratory (Sample Syllabus)

Instructor: Dr. Sen-ching Cheung
Office: 687B FPAT
Office Hours: MWF, 9:00am-11:00am
Phone: 257-9113
Email: cheung@engr.uky.edu

Prereq: EE 421G, MA320
Web Page:
http://www.vis.uky.edu/~cheung/courses/ee422G/fall06.html

Texts (required)

1. ECE 422 Lab Notes
2. R.E. Ziemer, W. H. Tranter and D.R. Fannin, Signals and Systems: Continuous and Discrete, 4th Edition. Prentice Hall, 1998. (ISBN 013496456X)

Course Summary

Lectures present new material on state variables and applications of random variables, as well as review topics from EE421G. Laboratory exercises provide opportunities for student to apply and implement concepts used in signals and systems to solve problems using modern engineering methods. Topics include noise models analysis, filter design, modulation techniques, sampling, discrete Fourier Transforms, State Variable Models, and feedback design with an emphasis on using computer software for analysis and simulation.

Prerequisites

EE 421G, MA320. Students taking EE 422G must be able to: apply convolution and Fourier methods to determine the output of linear time-invariant systems, Analyze continuous-time modulation systems and filters, Analyze discrete-time systems with the difference equations and z-transforms, Characterize input-output relationships of linear time-invariant discrete-time systems using impulse response and transfer function representations, Analyze discrete-time digital filters, model random variation with common distribution functions. Also it is helpful to have a background in matrix algebra, and knowledge of a programming language such as Matlab.

Grading Policies:

Grading:	Pre-lab assignments (8)	32%
	Lab Effort Plan (1)	2%
	Lab Reports (8)	40%
	Special Assignments (3)	10%
	Final Exam (1)	16%

Graduate students taking this course will have more difficult special assignments and additional final exam questions commensurate with the analysis expected of a student with a completed Bachelor's degree.

Undergraduate Students: Grades will be assigned using a10-point scale (A: 90+% of total points assigned, B: 80+%, C: 70+%, D: 60+%, E: Less than 60%.

Graduate Students: Grades will be assigned using a10-point scale (A: 90+% of total points assigned, B: 80+%, C: 70+%, E: Less than 70%.

Laboratory Reports: Each laboratory assignment is made up of two parts, the pre-lab (analysis and programming) and corresponding lab exercise (implement, measure, and interpret). The lab report will be due at the beginning of the next laboratory section meeting. Late assignments will be accepted with a 0.25 point per day penalty. You may work in groups up to 3 students in the laboratory; where the group turns in a single pre-lab assignment and a single lab report. The report is graded on organization, completeness, clarity, and accuracy. All lab reports must be prepared in a word processor and printed out. Program written for the lab must be commented and place in an appendix of the lab report.

Pre-Lab Assignments: Pre-lab assignments typically involve an analysis/synthesis of the system/problem used in the experiment. The responses to the pre-lab questions must be handed in at the end of the lab period where the lab assignment was performed. You can hold on to the pre-lab assignment during the lab to use as a reference. There will not be enough time to do the pre-lab and the lab in the 3 hour allotted period. **If you do not finish the experiment in the 3 hour time period, you will NOT be allowed extra time.** The pre-lab assignments can be handwritten, but must be legible and organized. The pre-lab is graded on completeness, clarity, and accuracy.

Final Exam: The final exam will cover the main topics of this course. Problems will be similar to those in the pre-lab exercises and issues related to those discussed in the discussion sections of the lab reports.

Lab Report Format: Lab reports must be prepared with a word processor and organized according to the following format:

- **Title Page**: This includes your name, lab partner's name, title of lab experiment, date of experiment, and date of completing the final write up.
- **Objectives**: Restate (copy) objectives from the lab assignment.
- **Solution/Procedure Description:** For each lab you need to implement some design concept that was either presented to you or resulted from a design that you solved for. The reader should be able to repeat your results based on the description provided (without reference to the original lab assignment document). Solutions or implementation strategies for each lab assignment will have multiple procedures and you need to describe each one. If a program was written to implement a solution, do not copy and past the program in the text. Describe what the program does (functional description) and include the actual code in an appendix. A flowchart may help clearly explain the program. The "*how*" questions for obtaining the results are answered in this section. When grading this section the reader will ask the question, "Can I repeat these measurements from the information given?" If it is not clear (as a result of missing, poorly organized, or ambiguous information) then points will be lost.
- **Presentation of Results:** For each major solution/procedure efficient methods and statistics must be used for presenting the results. This typically includes performance metrics presented in tables and/or waveforms in figures. All axes must be labeled as well as columns and rows of tables. All figures and tables should be numbered and referred to in the text. Do not include a table or figure without introducing it within the text. The actual data generated/recorded must be presented in this section along with any analysis (formula or code description) used to estimated parameters or functions of the original data. The "*what*" questions concerning the results are answered in this section.
- **Discussion of Results:** This section can vary significantly in length and analysis depending on the solution and results. It typically includes a comparison of results between the implementation and the pre-lab predictions or what was expected. There are discussion questions in the lab assignment to help direct your writing. Make sure you address these questions in your report, in addition to whatever other issues you as an engineer consider significant or important. The primary propose of this section is to interpret and explain the results. The "*why*" questions concerning the results are answered in this section.
- **Conclusions:** Summarize your results relative to the lab objectives. Assess how well the lab met the objectives. If applicable, suggest ways to improve the experiment, or how you may do things differently if experiment was repeated.

Lab Effort Plan: The first lab group activity is to determine how the work load should be divided up and agree on what is expected of each other. The main tasks are programming, handling and processing the data, completing the pre-lab assignment, organizing and writing the lab report, and proofreading and editing the lab report. For each lab clearly delineate responsibilities. Also schedule time outside of the lab and lecture meetings to work on the pre-lab and lab write-up. Since this is a 2 credit hour lab, 4-6 hours per week should be scheduled outside of class time to complete pre-lab and lab write-up assignments. A good lab plan lists the major components for each lab assignment, the person responsible, and the tentative time in the week that will be devoted to it over the whole semester. Make sure all 8 labs are covered by this plan. This will be handed in at the lecture following the first lab. This is a tentative plan and can change with mutual agreement between lab partners.

Lab assignments can be made up only in the case of excused absences. The lab reports are due in the next lab meeting after the lab where measurements are made.

Expected Student Learning Outcomes for EE 422G.

After completing this course, you will be able to:

1. Characterize random signals with correlation and probability density functions
2. Analyze discrete-time signals with the (discrete) Fast Fourier transform.
3. Design FIR and IIR filters based on signal and noise specifications.
4. Characterize system dynamics using impulse responses, transfer functions, and state-variable representations.
5. Simulate signals and systems using modern computer software packages
6. Design experiments to estimate signal and system model parameters from input and/or output data.

EE422G Topics:

Labs will be implemented in Matlab, Simulink, and Labview. Some extra labs and lecture time will be given to some of the more involved topics.

1. Lab1. Noise modeling (2 weeks)
2. Lab2. Sampling and Quantization (1 week)
3. Lab3. FIR Filter Design (2 weeks)
4. Lab4. IIR Filter Design (1 week)
5. Lab5. Noisy Digital communication channel simulation (1 week)
6. Lab6. Correlation receiver simulation and performance (1 week)
7. Lab7. Pole placement and system response. (1 week)
8. Lab8. State Variable Model and simulation (2 weeks)