1. Catalog Description
Theory, analysis, and design of controls of mechanical engineering systems; including mechanical, electromechanical, hydraulic, pneumatic and thermal components and subsystems. (3 credits)

2. Pre-requisites and Co-requisites
MAP 2302, EGM 3400 or EGM 3401

3. Course Objectives
By the end of this course, you should be able to do the following: Write differential equations describing the behavior of engineering systems; Use the Laplace transform to describe the transfer function of engineering systems and determine the time domain response to a wide range of inputs; Use state-variable equations to model engineering systems and determine their time response to a wide range of inputs; Describe the advantages of feedback control; Analyze the performance of control systems; Determine the stability of control systems using Root-Locus, Bode, and Nyquist methods; Design feedback control systems using root-locus, frequency domain and state-variable methods.

4. Contribution of course to meeting the professional component
This course contributes to enhancing the student’s knowledge of advanced mathematics through multivariable calculus, differential equations, and linear algebra. This course also contributes to the student’s ability to work professionally in mechanical and aerospace systems areas including design and analysis of such systems. The course supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and Aerospace Engineering. Specific ME and AE program outcomes supported by this course include: (1) Using knowledge of advanced mathematics through multivariate calculus and differential equations (ME and AE Program Outcomes M2 and A2); (2) Be familiar with linear algebra (ME and AE Program Outcome M3 and A3); (3) Possess knowledge of stability and controls (AE Program Outcome A5).

4B. Mathematical Sciences (30%), Engineering Sciences (40%), Engineering Design (30%)

5. Relationship of course to program outcomes
This course achieves the following ABET outcomes [note that the outcome number corresponds to the respective ABET outcomes (a) through (k):

(a) This course will provide the student with the ability to apply knowledge of mathematics, science, and engineering through an analytical treatment of differential equations in control systems [high coverage, method of assessment is quizzes, homework assignments and 4 exams].

(c) The student will gain knowledge related to how signals are used for feedback that gives insight into the ability to design a system, component, or process to meet desired needs [high coverage, method of assessment is quizzes, homework assignments and 4 exams].

(e) The student will learn to identify, formulate, and solve control engineering problems [high coverage, method of assessment is quizzes, homework assignments and 4 exams].

(i) The student will recognize the need for, and engage in life long learning [low coverage, method of assessment is a critique of a research paper in the field of Control Systems and/or a seminar focused on Control Systems and/or an approved organized tour of a laboratory engaged in controls research].

(k) Modern engineering tools such as mathematical computer simulation packages (e.g., MATLAB/Simulink) will be used to help prepare the student for professional careers [low coverage, method of assessment is project].
6. Instructor
Dr. Gloria J. Wiens
MAE-A 310, Phone: 352-392-0806, E-mail: gwiens@ufl.edu

Office Hours:
Monday, 9\textsuperscript{th} Period (MAE-A 310)
Wednesday, 11\textsuperscript{th} and E1 periods – ‘recitation style’ (NEB 100 – except for dates Sept 10 and 24 in LIT 101)

7. Teaching Assistants
He Hao, Joseph Knuth, Siddhartha Metha, and Youngjin Moon, He Hao

8. Meeting Times
Regularly Scheduled Lectures: Monday, Wednesday, Friday, 11:45am – 12:35 pm (5\textsuperscript{th} period)

Plus Special Sessions: Wednesday, 4:05pm – 4:55pm (9\textsuperscript{th} period)
Special Session Dates: 8/27, 9/3, 9/10, 9/24, 10/1, 10/22, 10/29 and 12/3
Will also be posted on E-Learning site for students to access after session prior to Friday’s lecture.

9. Class/Laboratory Schedule/Homepage
www.mae.ufl.edu/samm/Courses/eml4312f08.html and E-Learning class site

10. Meeting Location
Regularly Scheduled Lectures: Weil Hall, Room 270
Special Sessions: NEB 201

11. Material and Supply Fees
None

12. Textbooks and Software Required

NOTE: This latest edition (release date - Dec 2007) has electronic supplements as well as an electronic version of the textbook. SEE "WileyPLUS" link via the textbook websites for more information.

http://he-cda.wiley.com/WileyCDA/Section/id-305807.html

For a greatly reduced rate you may purchase an electronic version (only) of the textbook!

There is also an optional supplement "JustASK Controls Solution Companion" that you can purchase bundled with the textbook or buy the on-line version. For more details, see above John Wiley website for information links.

Matlab/Simulink Software ➔ with Controls Toolkit

13. Recommended Reading
Control Systems Engineering, JustAsk! Control Solutions Companion, 4th Edition

Tutorials to mathematical software Matlab/Simulink (see links on Course Website)
14. Course Outline
1. **Introduction** (1 to 2 lectures)
2. **Modeling Physical Systems and Mathematics** (11 lectures) – includes Laplace transform, development and solution of differential equations, partial fraction expansion, inverse Laplace transform, stability, time response, signal flow graphs, mason’s rule, block diagram construction and reduction
3. **Frequency Domain Analysis and Design** (22 lectures) – includes root locus, magnitude and angle condition, time response characteristics, steady state error, lead/lag compensation, Bode plots, Nyquist plots, Nyquist Criterion, Nyquist plot control design
4. **State-Space Analysis** (3 lectures) – state-space equations, matrix review, Eigenvalues, Eigenvectors, state transition matrix, state space solutions
5. **State-Space Design** (2 lectures) – Pole placement design, Ackerman’s Formula, state space observers, state space regulators
6. **Advanced Topics** (2 lectures) – Example topics such as polynomial design, discrete time design, similarity transforms, linearization of nonlinear systems, nonlinear systems introduction

Reading and Project Assignments will be posted on course website (see item 9 for web address).

15. Attendance and Expectations
- Attendance to lectures is expected. If you must miss lecture for any reason, you should obtain the lecture notes from another student. Students will be held responsible for knowledge of all scheduling and policy announcements made in class and on course website.
- Students are expected to take a sincere interest in learning the classroom material. Keeping with this expectation, students should: 1) not create distractions (i.e., turn cell phones off); and 2) show up to class on time.
- There will be short quizzes throughout the semester administered during the Wednesday or Friday lectures. No prior announcement will be made as to which lectures will have quizzes. Students will be allowed to miss 2 quizzes without it directly affecting their grades. No makeup quizzes will be given.

16. Grading
Students will be evaluated from their grades on the following, which are weighted as follows.

- 15% Quizzes (during Wednesday or Friday lectures), Homework (one problem collected per week), Project(s), Seminar/Review Paper/Lab Tour Critique & Class Participation
- 60% Exam 1, Exam 2 and Exam 3 (Based on TOP 2 Exam Scores out of the 3 Semester Exams)
- 25% Final Exam (Each student is required to take this Exam)

ALL Exams MUST BE WRITTEN and SUBMITTED on the pages of the ‘Examination’ handed out at the time of the exams. No additional or loose pages will be allowed during the exam nor accepted afterwards. Prior to each exam, the student may use one “8.5 inch x 11 inch” single sheet (both sides) for listing formulas and refer to it during the exam. This sheet must be clearly marked indicating that it is the formula sheet, and will not be graded as part of the solution to the exam.

17. Grading Scale
A: 90+      B+/B: 80-89       C+/C: 70-79       D+/D: 60-69       E: 59-

18. Make-up Exam Policy
Make-up exams will not be given since students are allowed to drop one of their three Semester Exams. Only extreme extenuating circumstances will be considered otherwise and not without a documented excused absence (e.g., documented extreme medical emergency).
19. Honesty Policy
All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities
Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services
Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

22. Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

23. Important Dates
Exam 1: Wednesday, September 17, 2008 at 6:15pm-10:20pm (periods 11 and E1 - TBD). Location: NEB 100.
Exam 2: Wednesday, October 15, 2008 at 6:15pm-10:20pm (periods 11 and E1 - TBD). Location: NEB 100.
Exam 3: Wednesday, November 5, 2008 at 6:15pm-10:20pm (periods 11 and E1). Location: NEB 100.
Final: Tuesday, Dec 16, 2008 (7:30am – 9:30am). Location: Weil 270

Holidays: Sept 1, Oct 24-25, and Nov 27-29

Special Sessions: Wednesday, 4:05pm – 4:55pm (9th period), will also be posted on E-Learning site.
Location: NEB 201 ---- Dates: Aug 27; Sept 3, 10 and 24; Oct 1, 22 and 29; and Dec 3

Project Overview: Wednesday, 11:45pm – 12:35pm (5th Period). Details of design project assignment and requirements will be discussed. At this time each Group’s specific project choice/assignment will be finalized and TA Project Coaches introduced.

No Lectures:
Two lectures during week of Oct 7, actual dates Oct 8 and 10.
Nov 7-26 (TA’s available to answer questions regarding design project during these lecture periods.)
--- Note, may be scheduling Matlab/Simulink tutorials during these periods as well as on Oct 8 and 10.