Department of Mechanical and Aerospace Engineering
The University Of Texas at Arlington
Introduction to Automatic Controls - ME 4310 – Summer 2013

Instructor: Dr. P. S. Shiakolas
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Course Web Page: Blackboard and http://mars.uta.edu/mae4310 (check regularly for announcements)
Office Hours: M W 10:15 – 11:00 am (strictly enforced) and by appointment
GTA: To be announced
Prerequisites: MAE 3319 and/or MAE 3405
Text: *Modern Control Engineering* by K. Ogata, 5th Edition
Description of Course Content: Introduction to Block diagram algebra, transfer functions and stability criteria. Use of transient response, root locus and frequency techniques in the performance, analysis, design, and evaluation of dynamic control systems. Introduction to State Space techniques.

Grading Policy – Expectations – Course Logistics

Assume no collaboration is allowed unless expressed permission is obtained from the instructor.

Anyone collaborating on PQ or HWs will be given a grade of zero on the particular assignment

Anyone collaborating on an exam will be given a failing grade in the course.

Pop Quizzes (0.75 pt each): Pop quizzes will be based on the assigned reading, material covered in class or material covered in previous lectures. A pop quiz might take place at any time during the lecture period and in addition to the above will also cover the material currently presented. There is no makeup for missed pop quizzes.
Homework (1.0 pt each): The purpose of the homework is to provide practice exercises that apply the theory and concepts presented in class in order to identify and improve on any deficiencies that might exist. It could be either analytical and/or computational. I reserve the right to inquire you to demonstrate your work. Homework is due at the beginning of class time. Late homework will not be accepted nor will you be able to make it up.
Semester Exam (25 pts): The exam will be comprehensive and **may** consist of two parts (an analytical and a computational). Note that part or the whole exam may be take-home. Any in-class exam will be closed book-notes-calculators-cellphones. The time of the exam will be announced later and will not necessarily last the whole class time.
Final Exam (40 pts): The final exam will be comprehensive and may consist of two parts; an analytical and a computational and will be closed book-notes-calculators-cellphones. The exam will be given at the university scheduled time. If there will be a computational part, it could be given the last week of classes.
Makeup Exam: No makeup exams will be given unless I am notified in advance and approve of it. If you miss an semester exam due to an illness or other approved reason, there will be only one comprehensive makeup exam the last week of the semester.
Key Assignment(s): In order to pass the class, students must submit and pass all key assignments; otherwise the student will not pass the class even if he/she scores perfectly on all exams and other assignments. The key assignments will be announced on time.
Attendance Policy: It is your responsibility to attend the lectures, participate in class discussion and keep up-to-date with the course material. I do not re-teach missed lecture material during office hours. Also, if you are habitually late, you will not be allowed in the classroom as this is disruptive to the other students.
Drop Policy: According to university regulations and schedule.
Guaranteed Grading Scale: The guaranteed grading scale based upon the minimum percentage number of points obtained is shown below. Note that no incomplete grade will be given unless prior arrangements are made and in extreme circumstances.
90% - 100%: A, 80% - 89%: B, 70% - 79%: C, 60% - 69%: D, 0 - 60%: F

Communication: Email communication will be through the MyMav system to your official UTA issued email account or through Blackboard or the class web page.

Software: You may use any computer software that you like and there are a many available such as SCILAB http://www.scilab.org, Octave http://www.octave.org, MATLAB http://www.mathworks.com, Mathematica http://wolfram.com, Maple http://www.mathsoft.com, LabVIEW MathScript http://www.ni.com and many others. Make sure that you can have access to the software during the semester and you are proficient in it for the purposes of this class.

Remember that computer tools are there to help you to better understand certain concepts – **DO NOT** just learn how to exercise the software tools but make sure you understand the underlying theory and concepts employed.

Additional Reference Material: Modeling and Controls related books are available in the engineering library and software resources available on the internet – some links are provided on class web page.

Miscellaneous: If you have a disability, any religious holidays that you need to observe or anything else that might interfere with this class and you would like for me to know about it, you must inform me in writing no later than the third class meeting.

The sciences do not try to explain, they hardly even try to interpret, they mainly make models. By a model is meant a mathematical construct which, with the addition of certain verbal interpretations, describes observed phenomena. The justification of such a mathematical construct is solely and precisely that is expected to work.

John Von Neumann

Tentative Topics (not in a particular order)

System Representation

A. Differential Equations (Rev)
B. Transfer Functions (Rev)
C. Block Diagrams
D. State Space (Rev)

System Transient Response Analysis

A. Pole, Zero Analysis
B. Time Domain Response
  - Analytic (Rev)
  - Computational) (Rev)
C. Frequency Domain Response
  - Frequency Response
  - Laplace Transform (Rev)
D. Stability

Feedback Control Systems

A. Effects of Feedback Control
B. Classical Control Action
  - Proportional (P), Integral (I), Derivative (D)
  - Combinations PI, PD, PID
  - Analog implementation

C. Error Analysis – Controller Design
  - Initial and Final Value Theorems
  - Static & Dynamic Error
  - Performance Indices & Controller Tuning
D. Sensitivity Analysis

Controller Design (Pole-Zero locations)

A. Root Locus Analysis
B. Frequency Response Analysis
  - Bode Plot
C. Compensation Analysis
  - Lead, Lag Compensation and combination

State Variable Feedback Systems – Modern Control

A. Controllability and Observability
B. Pole Placement Design
C. Observer Design - Optimal Control (time permitting)
D. Estimation and Kalman filtering (time permitting)

Digital Control Systems (time permitting)

A. z-Transform and Bilinear Approximation
B. Sampling Rate
C. Hardware Controller Implementation and Demonstrations

KEEP FOR YOUR RECORDS

Americans with Disabilities Act
The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112-The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act – (ADA), pursuant to section 504 of The Rehabilitation Act, here is renewed focus on providing this population with the same opportunities enjoyed by all citizens. As a faculty member, I am required by law to provide "reasonable accommodation" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty at the beginning of the semester and in providing *authorized* documentation through designated administrative channels. If you require an accommodation based on disability, I would like to meet with you in the privacy of my office no later than the second class meeting to make sure that you are properly accommodated.

Academic Dishonesty
It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspensions or expulsion from the University. "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)

University of Texas at Arlington Honor Code
The University of Texas at Arlington Honor Code can be found at **http://www.uta.edu/conduct/.**

> I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.
>
> I promise that I will submit only work that I personally create or that I contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

College of Engineering Ethics
The college of engineering ethics tutorial is at https://www.uta.edu/engineering/academics/ethicstutorial.php.
You are required to go through the tutorial and sign and return the attached sheet indicating you carefully went over the material, you understand the implications of the presented material and that you will abide and follow the instructions. You must return this at the second class meeting. You will not be allowed in the class if you do not return this form.

By signing below, I affirmed that I have gone through the college of engineering ethics tutorial and that I will follow the instructions, guidance and rules given in the tutorial.

Name (Block letters)

Student ID

Date

Signature

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SIGN AND RETURN TO INSTRUCTOR BY SECOND CLASS MEETING

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