Department of Mechanical and Aerospace Engineering
The University Of Texas at Arlington
Classical Methods of Control Systems Analysis and Synthesis
ME 5303 - SPRING 2015

Instructor: Dr. P. S. Shiakolas
Office: 315 D Woolf Hall, **Phone:** (817) 272-5715 **Email**: shiakolas@uta.edu
Course Web Page: http://mars.uta.edu/me5303 (check regularly for announcements)
Office Hours: TBA (will be strictly enforced) and by appointment
Prerequisites: Graduate Standing or Consent of Instructor, Introductory Modeling and Simulation
Text: *Modern Control Engineering* by K. Ogata, 5th or 4th Edition

Course Syllabus and Grading Policy

Homework: 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. It is your responsibility to attempt, solve and understand the assigned homework. You can solve more problems from the textbook should you need more practice. Remember do not just exercise the computer tools but rather spend the time to understand the concepts the problem addresses and further experiment with the concepts. Questions on HW will be answered in class or during office hours or *through email only for DL students*. Discussion forums will be setup on Blackboard if you ask for them and provide the discussion topic. *HW will be collected but not graded. HW will be assigned based on 5th edition.*

Semester Exam (25 points): There will be only one comprehensive mid-semester exam usually the week before or after spring break. It may consist of two parts (an analytical and a computational). Note that part of or the whole exam may be take-home. Any in-class exam will be closed book-notes-electronic devices.

Final Exam (40 points): The final exam will be comprehensive and may consist of two parts; an analytical and a computational and will be closed book-notes-electronic device. *The exam will be given at the university scheduled time.* If there will be a computational part, it will be given the last week of classes.

Distance Learning Students: If possible, DL students can take the exams with on-campus students, or they must make arrangements to take the exams at the same time and day as the on-campus students.

Makeup Exam: No makeup exams will be given unless I am notified in advance and approve of it. There will be only one comprehensive makeup exam the last week of the semester.

Attendance: It is your responsibility to attend the lectures, participate in the class discussion and be up to date with the course material. I will not re-teach material covered in class during office hours.

Guaranteed Grading Scale: Grading scale based on the minimum percentage number of points obtained: **90% - 100%: A, 80% - 89%: B, 70% - 79%: C, 60% - 69%: D, 0 - 60%: F**
No incomplete grade will be given unless prior arrangements are made and in extreme circumstances:

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate catalog.
http://wweb.uta.edu/catalog/content/general/academic_regulations.aspx#10

Software: You may use any computer software that you like such as SCILAB http://www.scilab.org, Mathematica http://www.wolfram.com, LabVIEW http://www.ni.com, MATLAB http://www.mathworks.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. Numerical simulation and analysis tools are part of prerequisites of the class.

Remember that computer tools are used to help you better understand certain concepts through experimentation. **DO NOT** just learn the software commands, but make sure you understand the underlying concepts. Use the software tools to perform What if scenarios.

Additional Reference Material: Modeling, Simulation and Controls related books are available in the engineering library and software resources available on the internet – check also the 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.

Email Communication: Email communication must be from your official UTA issued email account or Blackboard utilities (http://www.uta.edu/blackboard/). The email subject line must be ME 5303 – SP 2015: Question on Root Locus

Any email communication for ME 5303 not adhering to the above guidelines will be deleted without any action taken on the content of the email. Email will be answered within one business day. Remember that proper decorum must be followed in all email communication.

Drop Policy: According to university regulations and schedule. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Emergency Procedures for Disabled Personnel

- If the disabled person cannot safely evacuate the building, one person should stay with the disabled individual while another person reports his/her location to the University Police.
- Hearing impaired and visually impaired persons need only one person each to notify them of a fire alarm or guide them to safe escape routes during an evacuation.
- After evacuating employees and students have cleared all stairways, disabled persons should be assisted to the stairwell landings to await emergency personnel. All doors to the stairwells must be kept closed during this time.
- NOTE: Environmental Health & Safety would like to offer the following reminders to those who are disabled or have special needs:
- Take control without depending on others to take the first step.
- Don't be afraid to let others know you need assistance.
- Don't hesitate to communicate what your special needs are in order to make the evacuation easier and safer for you and for your assistants.
- Communicate with those who can help as soon as you are able by dialing 3003 to campus Police.
- Plan ahead. Be prepared. Know what you are going to do before an emergency arises. Make a plan and then test it. Determine what your alternatives are.
- When you enter an unfamiliar building, look it over and locate the most available telephones, note horizontal exits and ramps, note exit signs and enclosed stairwells determine if landings are large enough), note rooms that would make good areas of refuge, and note the location of fire alarm pull stations.
- Never take an elevator in a building on fire.
- Don't delay your evacuation or communication to evacuate. Speaking with someone over the telephone will help to keep you calm.

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**

ME 5303 Tentative Topics (not in a particular order)

System Representation

A. Differential Equations
B. Transfer Functions
C. Block Diagrams
D. State Space - Linearization

System Transient Response Analysis

A. Time Domain Response
B. Frequency Domain Response
C. Stability

Feedback Control Systems

A. Effects of Feedback Control
B. Classical Control Actions (P, I, D)
C. Error Analysis – Controller Design
D. Sensitivity Analysis

Controller Design (Pole-Zero locations)

A. Root Locus Analysis
B. Frequency Response - Bode Plot
C. Compensation Analysis – Lead & Lag
D. Analog Controller Design/Representation

State Variable Feedback Systems

A. Controllability and Observability
B. Estimation
C. Optimal Control
D. Controller Design

Introduction to Advanced Control Concepts (time permitting)

A. Neural networks
B. Fuzzy logic

Hardware Demonstrations (time permitting)

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

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.

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)

Classical Methods of Control Systems Analysis and Synthesis - ME 5303

KEEP FOR YOUR RECORDS

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

Student ID

Date

Signature

Classical Methods of Control Systems Analysis and Synthesis - ME 5303

SIGN AND TURN IN ON THIRD CLASS MEETING

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

Student ID

Date

Signature