

**Department of Mechanical and Aerospace Engineering**  
**The University Of Texas at Arlington**  
**Classical Methods of Control Systems Analysis and Synthesis**  
**ME 5303 - SPRING 2014**

**Instructor:** Dr. P. S. Shiakolas

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**Course Web Page:** <http://mars.uta.edu/me5303> (check regularly for announcements)

**Office Hours:** TBA (and 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 (1 point 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. Not all HW problems will be graded. It is your responsibility to attempt, solve and understand the assigned homework. Late homework will not be accepted. 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 spring break. It **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-electronic device. The distance learning students must make arrangements to take the exam at the same time as the on-campus students.

**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. Distance learning students must make arrangements to take the final at the same time as the on-campus students. 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. 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 do not and will not re-teach material covered in class during office hours.

**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**

**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](http://wweb.uta.edu/catalog/content/general/academic_regulations.aspx#10)

**Software:** You may use any computer software that you like and there are many available 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.

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

**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 through your official UTA issued email account and Blackboard utilities (<http://www.uta.edu/blackboard/>).

**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://www.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.**

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**John Von Neumann**

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### **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. Pole - Zero Analysis
- B. Time Domain Response
- C. Frequency Domain Response
- D. Stability

#### **Feedback Control Systems**

- A. Effects of Feedback Control
- B. Classical Control Actions (P, I, D)
- C. Error Analysis – Controller Design
  - Initial and Final Value Theorems
  - Performance Indices
- D. Sensitivity Analysis

#### **Controller Design (Pole-Zero locations)**

- A. Root Locus Analysis
- B. Frequency Response - Bode Plot
- C. Compensation Analysis – Lead & Lag

#### **State Variable Feedback Systems**

- A. Controllability and Observability
- B. Optimal Control
- C. Estimation

#### **Introduction to Advanced Control Concepts (time permitting)**

- A. Neural networks
- B. Fuzzy logic

#### **Introduction to Digital Control Concepts (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 93-112-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)

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### **KEEP FOR YOUR RECORDS**

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#### **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

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### **SIGN AND TURN IN ON THIRD CLASS MEETING**

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