MECH 3140: SYSTEM DYNAMICS AND CONTROLS

Fall 2019

Instructor: Dr. David M. Bevly (Wiggins 2418F)
Phone: 844-3446
Email: bevlydm@auburn.edu (not for asking questions unless on travel)

Office Hours: (If door is open) M 5-6, T 3:30-5, W 2-3, F (generally)
Peer Tutoring (Jack Crouch): Tuesday 6-7 pm, Lowder 126
Problem Working Session (Christian Campos): Wed 5-6 pm, Shelby 1126

Franklin, Powell, Emami, “Feedback Control of Dynamic Systems”

Course Website: http://www.eng.auburn.edu/~dmbevly/mech3140/

Pre-Requisites: MECH 2120; MATH 2650.

Grading Policy:
1. 2 semester exams (2 X 15 points) 30
2. Matlab Assignments 8
3. Pre-Requisite Quiz 2
4. Projects (mid –5, final – 10) 15
5. Quizzes 20
6. Final Exam (Comprehensive) 25

Total 100

Scale:

90-100 - A 70-79 - C
80-89 - B 60-69 - D
Below 60 - F

Note you must work problems 2-3 hours per day in order to succeed in this class. Do not get behind as everything in this class builds on itself and it is impossible to catch up. The final exam will be comprehensive as the class is quite comprehensive in nature. This is a challenging class, but one you should look forward to applying your engineering knowledge and capabilities gained to this point in your career. We will add up to 2 points to your final average for BOPS.
Tentative Lecture Topic Outline (Subject to Change)

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<tr>
<th>WEEK</th>
<th>TOPIC</th>
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<tr>
<td>1</td>
<td>Laplace Transform and Transfer Functions</td>
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<tr>
<td>2</td>
<td>Modeling Mechanical Systems</td>
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<td>3</td>
<td>Modeling Electrical Systems</td>
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<td>4</td>
<td>First Order Time and Frequency Response</td>
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<td>5</td>
<td>Intro to Controls</td>
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<td>6</td>
<td>Modeling with additional energy storage elements</td>
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<td>7</td>
<td>Second Order Time Response</td>
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<td>8</td>
<td>Second Order Frequency Response</td>
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<td>Second Order Control Design</td>
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<td>10</td>
<td>Modeling higher order and multi-DOF systems</td>
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<td>11</td>
<td>Linearization, State Space and Transfer Function Representation</td>
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<td>12</td>
<td>Time and Frequency Response of Higher Order Systems</td>
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<td>13</td>
<td>Bode Plots and Higher Order Control</td>
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<td>14</td>
<td>Root Locus</td>
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<tr>
<td>15</td>
<td>More on Root Locus (Lead/Lag), Conclusion and Review</td>
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Tentative Schedule for Exams
Exam 1: Night exam ~ week of 9/30
Exam 2: Night exam ~ week of 11/4
Final Exam: December 13 @ 4:00 PM (from course schedule bulletin)

Homework and Quizzes
Suggested homework problems will be given but not collected. Quizzes will be given (unannounced) to measure the understanding of the homework problems. We will drop 1-2 quizzes (however, make-up quizzes are not eligible to be dropped). Occasionally, the homework problems will include a “MATLAB” problem that will be collected and graded. Students should not expect (and will NOT) be successful in this class with out dedication toward reading the notes and book, as well as working homework problems!

General Policies
Class attendance is expected but not formally recorded. Late submission of assigned work or make-up examinations will be allowed if and only if accompanied by an approved University excuse. Additionally, I expect a very high standard of honesty among students at Auburn University as I feel that engineers with moral integrity is of the utmost importance in society. Because of the importance of academic honesty to the reputation of Auburn Engineers, I will report violations of academic honesty as outlined in the Auburn Tiger Cub. This includes plagiarism of software! Additionally, answers which do not show the necessary steps will not receive credit!

Accessibility
It is the policy of Auburn University to provide accessibility to its programs and activities, and reasonable accommodations for persons defined as having a disability under Section 504 of the rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. Students who need special accommodations should make an appointment to see the instructor as soon as possible or contact The Student with Disabilities Program office at (334) 844-5943 (Voice/TT)
Bonus Opportunity Points (BOPs)

Over the past couple of years it has become apparent that students are working less and less problems which is a critical part of learning at this level. Students must be reading the text and working relevant problems. You WILL NOT be successful and CAN NOT learn the material simply by attending lectures. Lectures ARE NOT meant to teach the material. Lectures are an opportunity for us to stress critical points of the material as well as discuss concepts and applications of the material.

Therefore in an attempt to try and better motivate students to read material and work problems, at the end of the semester we will collect your work from the semester. This work should include all assigned homework problems, re-worked quiz and exam problems, as well as any additional work assigned in class or done individually as working through the class. The work should be maintained according to the Mechanical Engineering Homework Standard. This work should be maintained in either:

1) Spiral Bound Notebook
2) Three Ring Binder

We will collect your notebook near the end of the semester and provide a 0, 1, 2 based on completion. Additionally, we may collect them for review periodically through the semester. These points will be added to your final class average. Note that zero credit will be received if it appears the work is copied from solution manuals or other students. Copying solutions from other sources does not result in learning.
Auburn University Department of Mechanical Engineering  
Universal Homework Format

**Turned-In Work Standards**

1. All assignments are to be submitted on single sides of clean 8.5 by 11-inch engineering paper with clean, straight edges. *A single staple in the upper left corner will be used to fasten multiple pages.* If the work includes plots and/or figures in the results, then these must either be drawn on engineering paper, or be computer-generated.

2. All marks and characters will be clear, neat, and legible, done with ink or lead that provides for an easily legible contrast.

3. Each page will be marked with:

   3.1. In the upper left corner:

       Name (Last name, First name)  
       Course and Section number  
       Due Date  

   3.2. In the upper right corner:

       Page x of xmax  (If a problem is on two pages, put “Page 1 of 2” in the upper right corner of the first page and “Page 2 of 2” on the second page. Number and staple each problem separately.)

4. Each exercise will note:

   4.1. Source of exercise (text problem number or other)  
   4.2. Statement of the exercise in the student's own words (reproduction of the assignment statement is NOT acceptable)  
   4.3. Statement of goals of exercise (what must be found)  
   4.4. Statement of methods and assumptions used to solve exercise  
   4.5. Statement of solution process (calculation, derivation, etc.)  
   4.6. Statement of results (suitably highlighted)  
   4.7. *All numerical values must be stated with appropriate units, without exception.*  
   4.8. A detailed nomenclature list for all symbols used including units.

Since only select individual problems will be collected and graded, *each problem should be ready to be turned in without disconnecting it from any other problem(s).*