Exam 3 Study Guide AND Homework M1 Exam 3 is Mon, 4/8/19

The exam will be **closed book**, but you may use the colored sheets from exam 1 and 2 the new one for exam 3.
Download old exams from HW page on class web site.

The exam will cover

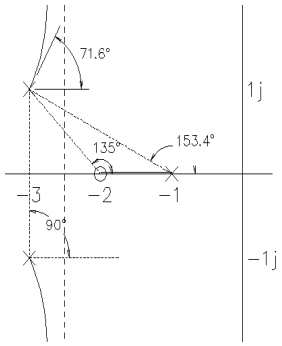
1. **Root - Locus method**
   a) **Main rules** (memorize, could be in closed-book part)
   b) **Gain at any point** on the root locus: $k = \frac{1}{|G(s)|}$ (both parts)
   c) Additional rules.

   The **breakaway/in points** are also solutions to: $\sum_{\text{all}} \frac{1}{(s + -p_i)} = \sum_{\text{all}} \frac{1}{(s + -z_i)}$

   Phase angle of $G(s)$ at any point on the root locus: $\arg(G(s)) = \arg(N(s)) - \arg(D(s)) = \pm 180^o, \pm 540^o, \ldots$

   Or: $\arg\left(\frac{1}{G(s)}\right) = \arg(D(s)) - \arg(N(s)) = \pm 180^o, \pm 540^o, \ldots$

   Departure angles from complex poles: Example. $180 - 90 - 153.4 + 135 = 71.6$ deg



2. **Root - Locus Interpretation and design**
   Concepts of what a root locus plot is and what it tells you. Movement of poles
   Good vs bad, fast response vs slow, OK damping vs bad.
   Compensators
   Know pole & zero locations of P, PI, lag, PD, lead & PID Compensators.
   PI and Lag, purpose and design, ties in with steady-state error
   PD and Lead, purpose and design ties in with root locus angle rules

   Choose points on the s-plane to achieve given required characteristics based on the 2nd-order assumption (RL Crib)
   Know that the 2nd-order assumption may be accurate if other CL poles and/or zeros aren't 5x farther from Imag. axis.

   Design of a compensator to force the RL point through a given point (like RL7).

3. **Unconventional root-locus**

4. Phase-locked loops — Material from labs — How and why did you use an unconventional root-locus
   How does it work — The loop block diagram

5. Compensator circuits & Instrumentation amplifier

6. PID tuning, memorize some basic ideas, like why you would need to do it.

7. PLCs and Ladder logic. AND, OR, XOR & basic switching logic could be asked in the closed-book part.

8. **Bode Plots** (limited to page 1 of notes)

   Be able to draw both magnitude and phase plots

   Be able to draw the smoth curves as well as the the asymptotic lines

   I may ask you to start with a circuit

   Basic rules

9. Concentrate on Homeworks RL5 - Bd1 I'll scan through for problems

10. Up to Lab 7 (Advanced PLL)

ECE 3510 homework # M1 Requires action on Thur, 4/18 Due Mon, 4/22

Go to ME Design day in the Union on Thursday, 4/18 sometime from 11:00 to 3:00.
See www.mech.utah.edu/events/designday.html Write **several paragraphs** about what you see there. Especially:

1. Note control systems and/or systems with feedback.
2. Tell which senior project most impressed you and why.
3. Observe at least part of one of the competitions (main mechatronics robot competition, 1:00 - 3:00) and write at least one paragraph about it (suggest improvements).