ECE210 / ECE211 - Homework 14

Due: Wednesday, May 4 @ 6.30pm.

NOTE: there will be a penalty-free grace period of 24 hours to submit this HW.

Homework Policy:

- HWs are due on Wednesdays at 6.30 p.m. and submissions will be made via Gradescope.
  You can find instructions on how to scan/upload your HW on the course website. Students have reported issues with some free scanning apps, so below we have instructions for scanning with two different free apps that work very well. Instructions on how to scan the pdf of the solutions in Android and in MacOS are also on the course website.

- Late assignments will be **deducted** 1% per late minute, so after 100 minutes, you will get zero, so please mark your calendar with the deadlines to avoid losing points. No exceptions, so don't wait until the last minute to submit it and then run into internet issues.

- In order to account for sickness, travel or internet issues, the lowest homework grade will be dropped for 211 students and the lowest two homework grades will be dropped for 210 students.

- Make sure you box your answers and match problem parts accurately in Gradescope, or you will be **deducted** 10% of the corresponding problem part. You can find instructions on how to do that on the course website

- Make sure that your HW is neat enough to read. Graders has the flexibility to **deduct** up to 20% for lack of neatness.

- Homework assignments in ECE 210 constitute an essential component of your learning experience in the course and prepare you for your mid-term 'hour exams' and the end-of-semester 'final exam' in most effective ways — investing time to do your homework with care will pay off when you are taking your exams.
  You will be expected to provide detailed explanations of your solutions in order to obtain full credit in your homework assignments. Conversely, solutions lacking full explanations will receive zero credit even when the answer provided may be correct and furthermore incorrect answers without any work shown may lead to '**academic integrity violation**' cases being opened against you and **sanctions** applied. Some of the homework problems you will be assigned will resemble problems from previous semesters but with modified parameters and/or inputs. Your comprehensive homework solutions will naturally be expected to match the versions of the problems assigned during the current semester, whereas solutions or answers matching the versions from previous semesters will once again lead to '**academic integrity violation**' cases being brought against you and **sanctions** applied.
  You are encouraged to collaborate to understand the problems in the homework sets, but each student should solve the problems individually for submission even if they work together initially to understand how to solve the problems. Copying a joint solution is not acceptable and it will lead to '**Academic Integrity violation**' cases being brought against you and **sanctions** applied.
  The same applies to using external resources: each student should solve the problems individually for submission even if you use external resources to understand how to solve the problems. Copying or "following" the solutions from an external resource is not acceptable.
  Please keep these cautionary remarks in mind as you are working out your homework assignments and **avoid** submitting unsubstantiated solutions to avoid any misinterpretations as explained above.

- Regrades: You will receive an email from Gradescope so you can log in and see your graded HW. If after looking at the posted solutions, you feel there was an inaccuracy in the grading of your HW, you can request a regrade within Gradescope itself. Make sure you submit regrade requests before 6.30pm on the Wednesday after your graded HWs are made available via Gradescope. Regrades will **not be accepted** after that date.

Problems:

1. Sign acknowledging you will abide by this course's and the University's Academic Integrity policies or face sanctions for not doing so. These policies include, among others, plagiarism: representing the words or ideas of others as your own; cheating: using unauthorized materials and/or information. The possible sanctions include, among others, point reduction, reduced letter grades and an F in the course. If your solution upload does not include your signature, your homework will NOT be graded, resulting in a zero.

   sign: _____

2. For each of the following transfer functions, $\hat{H}(s)$, determine the inverse Laplace transform $h(t)$ and also indicate if the system is BIBO stable or not.

   (a) $\hat{H}(s) = \frac{s+3}{(s+2)(s-4)}$

   (b) $\hat{H}(s) = \frac{2}{s(s-4)^2}$

   (c) $\hat{H}(s) = \frac{s^2+4s+4}{(s+1)(s+2)}$

   (d) $\hat{H}(s) = \frac{s^3}{s^2+4}$

   (e) $\hat{H}(s) = \frac{e^{-3s}}{(s+1)(s+2)}$

   (f) $\hat{H}(s) = \frac{s+1}{s^2+3s+2}$

3. Determine the zero-state response, $y_{ZS}(t)$, of the LTIC system given with transfer function

$$\hat{H}(s) = \frac{1}{(s^2+9)}$$

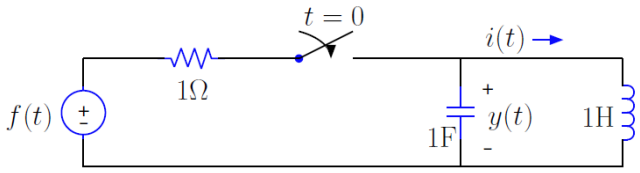
   to an input $f(t) = \cos(2t)u(t)$.

4. For each LTIC system described below, determine its transfer function, $\hat{H}(s)$, it characteristic poles, its characteristic modes, the zero-input response, $\hat{Y_{ZI}}(s)$ and the zero-state response, $\hat{Y}_{ZS}(s)$. Also indicate if the system is BIBO stable, asymptotically stable and/or marginally stable.

   (a) $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 8y(t) = 6f(t), \quad y(0^-) = 0, \quad y'(0^-) = 1, \quad f(t) = e^{-3t}u(t).$

   (b) $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y(t) = 2f(t), \quad y(0^-) = 1, \quad y'(0^-) = 1, \quad f(t) = \delta(t).$

5. Consider the circuit below, where $f(t) = e^{3t}$ V, $y(0^-) = 1$ V, and $i(0^-) = 0$.



   (a) Show that the transfer function of the circuit for $t > 0$ is $\hat{H}(s) = \frac{\hat{Y}(s)}{\hat{F}(s)} = \frac{s}{s^2+s+1}$.

   (b) What are the characteristic poles and the characteristic modes of the circuit?

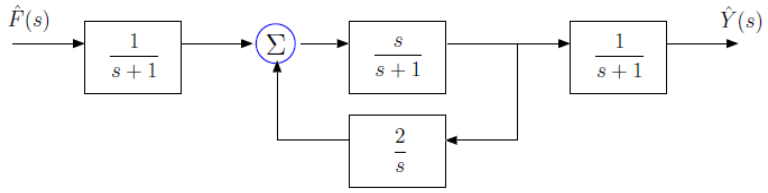
   (c) Determine $y_{ZS}(t)$ for $t > 0$.

   (d) Determine $y_{ZI}(t)$ for $t > 0$.

   (e) Determine $y(t)$ for $t > 0$.

   (f) Indicate if the system is BIBO stable, asymptotically stable and/or marginally stable.

6. Determine the transfer function $\hat{H}(s)$ of the system shown below. Also determine whether the system is BIBO stable or not.



7. For ECE 210 students only. If you are participating in the extra credit research study that Dr. Gertner emailed about, please complete this short two-question survey available through this link or through this QR code: