Lessons Covered: Lesson38 - Lesson39
HW should be turned in by Monday, Oct. 13, before 4:30pm

Solve all the problems. All problems will not be graded, only a selection of HW problems will be graded.

Show all relevant steps. Don’t just write down the answers.

Late HWs will not be accepted. HW with lowest grade will be dropped. Lecture Students: turn in your HW in class. Recitation students: turn in your HW at the ECE Office Front Desk. HWs turned-in anywhere else will not be accepted.

Show your work on these pages, attach additional pages if necessary.

• Be sure to organize the pages in order and staple them all together, otherwise you will lose one point

• Fill out the following section. You will lose an additional point if you fail to provide these details

Your Last Name_____________________________
Your First Name____________________________

1. Lecture Student __________ or Recitation Student__________ (check one)
2. If Recitation then fill out the following
   Name of recitation instruction____________________ Date/time of recitation___________
3. Your Lab Section/Group________________________________________
Problem 1: The poles and zeros of a system are given below. Determine the System Function. Is this an FIR or an IIR system? Is the system stable or unstable? Why?
**Problem 2:** Determine the Difference Equation and impulse response of the system in Problem 1. Plot the impulse response (lollipop diagram).
**Problem 3:** The poles and zeros of a system are given below. Determine the System Function. Is this an FIR or an IIR system? Is the system stable or unstable? Why?
Problem 4: Determine the Difference Equation of the system in Problem 3.
Problem 5: Express the System Function given below as a partial fraction expansion. Determine the residues of the partial fraction expansion by using MATLAB. Staple your MATLAB work to this page.

\[
H(z) = \frac{1}{(1 - 0.5z^{-1})(1 + 0.5z^{-1})}
\]
**Problem 6:** Determine the residues of the partial fraction expansion of problem 5 by hand. Compare with MATLAB results from problem 5.
Problem 7: Use the results of Problem 6 to determine the impulse response of the system.
Problem 8: Express the System Function given below as a partial fraction expansion. Determine the residues of the partial fraction expansion by using MATLAB. Staple your MATLAB work to this page.

\[ H(z) = \frac{(1 - Z_1 \bar{z}^1)}{(1 - p_1 \bar{z}^1)(1 - p_2 \bar{z}^1)} \]

\[ Z_1 = -0.5, \quad p_1 = \frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}, \quad p_2 = p_1^* \]
**Problem 9:** Use the results of Problem 8 to determine the impulse response of the system.
Problem 10: Design an FIR notch filter with a notch at 200Hz. Use $fs = 1000$Hz for the sampling frequency. What is the difference equation of the designed system?
**Problem 11:** Use MATLAB to plot the frequency response (vs. Cycles/sample and vs. Hz) of the system designed in Problem 10? Attach your MATLAB work here.