Spring 2006 **EE 3120** Complete: H3.1 by 1:00pm Fri.
Homework Set for Week 3 H3.2 and H3.3 by 1:00pm Mon.

Since one of these problems could be collected, work each problem on separate sheet of paper.

Comments and Background:

Homework problems are designed to reinforce key concepts introduced in class. If you work the problems thoroughly, grasp the underlying concepts, and develop some insights, you should do very well on the tests.

Focusing on concepts and developing good engineering intuition is vital to us in our careers. In order to correctly analyze and design things, we must understand the underlying concepts and assumptions, choose or derive the correct equations, and develop a feeling for whether the calculations are correct.

I encourage you to use this opportunity to develop a sound and efficient approach to problem solving and documentation. Where did the equation come from? What simplifying assumptions have you made? Always sketch out the circuit first. Make your diagrams "plenty big" so you can clearly label voltages, currents, polarities, sources, impedances, etc. Circle important answers or solutions. Use tables to organize data and results. Develop an efficient but clear style of writing and sketching - could someone take your work out of the project archives 20 years from now and follow what you did?

H3.1 - Refer to the technical specs in the .ppt presentation on Hoover Dam's hydro generators.
a) What is the range of hydraulic "head" available to the generators? Why does this fluctuate? For a given flow of water, what general effect does this fluctuation in level have in terms of how much power can be generated?
b) For the high-water level, calculate how many gallons/second of water need to flow through the penstocks to produce the rated GWs of generator output.
. c) Repeat this calculation for the low-water level. Comment/explain the difference.

H3.2 - Heat rate describes the relationship between input energy of a fossil fuel plant and the electrical output produced.
a) What is mathematical definition of Heat Rate? Gross Heat Rate? Net Heat Rate?
b) For a plant that has a Net Heat Rate of 4000, calculate the efficiency in %.
c) Comment on how the type of fuel, auxiliary systems, and other effects can affect the heat rate.

H3.3 - A resistance of 9 Ohms is placed in series with an inductance of 35 mH.
a) At 60 Hz, what is its impedance Z?
b) What is its power factor?
c) It's desired to improve its power factor to 0.9 Lag by placing a capacitance in parallel. Calculate the value of this capacitance in μF. (Again, it is operating at 60 Hz).
d) State the value of the impedance in part a) as an equivalent admittance Y.
e) What are the values of the 2 parallel elements that make up this equivalent admittance?
f) Make a comparison of the frequency response of the impedance of part a) with the admittance of part d). (Hint: we know that they are the "same" at 60 Hz, but how do their respective values change as operating frequency is increased or decreased?)