ENEE 460 Fall 2016 **Homework Set 8**: Assigned Sunday November 13, 2016 - due back at the start of class on Monday, November 21, 2016

1. READING ASSIGNMENT – Chapter 7, section 7.3 (design considerations) beginning on page 7-17 of the PDF version of chapter 7 (STATE FEEDBACK). A goal for this reading would be to get an understanding of the design of state feedback by Linear Quadratic Regulator (LQR) Theory, as an alternative to some of the methods preceding the discussions of this theory (on pages 7-25 to 7.27). Specifically read closely the discussion of Exercise 7.8.

2. Problem – Set up the linearized form of Example 7.8 by using the parameters given. First note that this is a 2 input system but the LQR theory applies to it. Let both Q matrices be identity matrices (6x6 and 2x2). Use the MATLAB command lqr to compute the optimal state feedback controller given by equations 7.27 and the equation preceding it. What is the state feedback control law you obtain in this way? You are required to compute (by MATLAB) the feedback matrix K. Substitute this feedback law in the closed loop system, and simulate in MATLAB to obtain step responses for x and y. Compare what you obtain with Figure 7.12. Provide Matlab code you used for doing this simulation. Provide MATLAB plot output.

3. Do problems 7.1, and 7. 4.

4. Read chapter 8 section 8.1 (observability), section 8.2 (state estimation) and section 8.3 (control using estimated state), inclusive. Material in section 8.3 will be covered on Monday November 14.

5. Do problems 8.1, 8.2 and 8.3.