ECEN/MAE 3723 Systems I
Fall 2006
Final Exam
December 12, 2006

Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;  

Name : ______________________________

Student ID: ________________________________

E-Mail Address: ________________________________
Problem 1: Using block diagram reduction technique to rearrange the following block diagram into the equivalent $H$ and $G$ configurations of the feedback control system shown below. Clearly identify the transfer functions for $G_p(s)$, $H_{eq}(s)$ and $G_{eq}(s)$. 

![Block Diagram](image-url)
**Problem 2:** Find the transfer functions $Y_8 / Y_1$ and $Y_2 / Y_1$ of the SFG shown below.
Problem 3: Figure below shows the block diagram of the antenna control system of the solar-collector field. The signal $N(s)$ denotes the wind dust disturbance acted upon the antenna. The feedforward transfer function $G_d(s)$ is used to eliminate the effect of $N(s)$ on the output $Y(s)$. Find the transfer function $\frac{Y(s)}{N(s)}\big|_{R=0}$. Determine the expression of $G_d(s)$ so that the effect of $N(s)$ is entirely eliminated.
Problem 4: Considering the feedback control system shown below, determine the feedback coefficients \( k_1 \) and \( k_2 \) so that the poles of the closed-loop control system are located at -5 and -7.
**Problem 5:** Obtain an *analogous* electrical circuits (using force-voltage analogy) for the mechanical system shown below.