O K L A H O M A   S T A T E   U N I V E R S I T Y

S C H O O L   O F   E L E C T R I C A L   A N D   C O M P U T E R   E N G I N E E R I N G

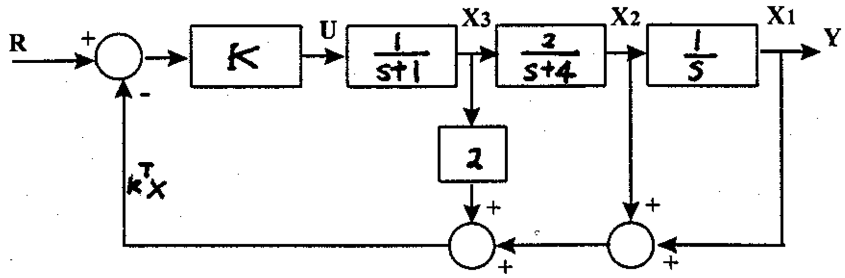
ECEN 4413/MAE 4053
Automatic Control Systems
Spring 2011
Final Exam

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

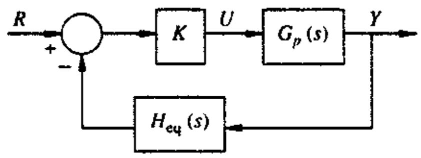
Name : ______________________________

E-Mail Address:_______________________________________

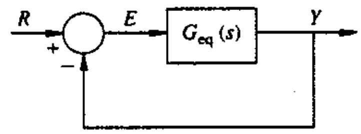
Problem 1:
Using the block diagram reduction, find the equivalent *H* and *G* configurations of the feedback control system shown below and then determine its respective closed-loop transfer functions $Y(s)/R(s)$ from the *H* and *G* configurations.



H Configuration



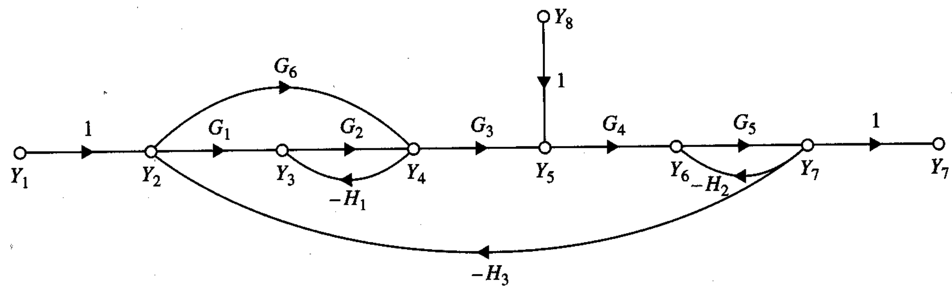
G Configuration



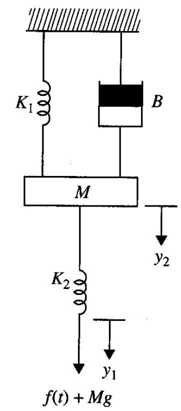
Problem 2:

Find the following transfer functions for the SFG shown below:

a) $\left.\dfrac{Y_7}{Y_1}\right|_{Y_8=0}$ and b) $\left.\dfrac{Y_7}{Y_4}\right|_{Y_1=0}$.



Problem 3:
Write the equations of motion for the linear translational system shown below. Draw the state diagram using a minimum number of integrators. Write the state equation from the state diagram. Find the transfer functions $Y_1(s)/F(s)$ and $Y_2(s)/F(s)$. Set $Mg = 0$ for the transfer function.



Problem 4:

Consider the closed-loop control system described by

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ -b_3 & 0 & 1 \\ 0 & -b_2 & -b_1 \end{bmatrix} x + \begin{bmatrix} 1 \\ b_1 \\ b_3 \end{bmatrix} r.$$

$$y = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix} x$$

Determine its stability criteria.

Problem 5:

Given the block diagram, explain why the goal of reduced sensitivity to output disturbance *D* conflicts with the goal of attenuation of sensor noise *N*.