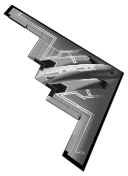
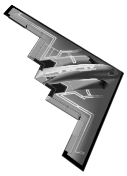
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING



ECEN/MAE 3723 Systems I
Section 001
Fall 2004
Final Exam
December 14, 2004



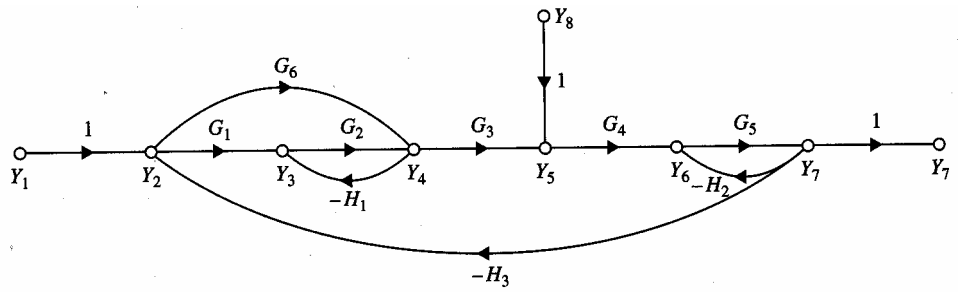
Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;

Name : _____

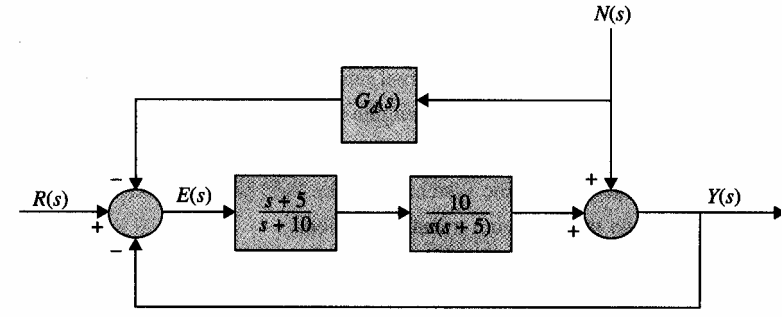
Student ID: _____

E-Mail Address:_____

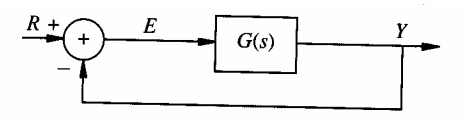
Problem 1: Apply the gain formula to the SFG shown below to find the transfer functions of $\frac{Y_7}{Y_1}$ and $\frac{Y_7}{Y_4}$.



Problem 2: 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 $Y(s)/N(s)\big|_{R=0}$. Determine the expression of $G_d(s)$ so that the effect of $N(s)$ is entirely eliminated.

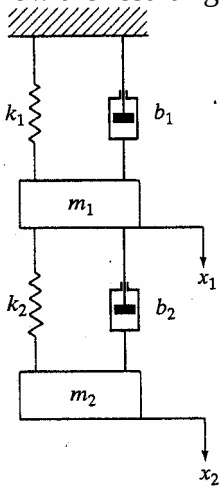


Problem 3: Find the range of K in $G(s)$ for which the G-configuration equivalent system shown below is stable.



in which $G(s) = \dfrac{9K}{s^3 + 3s^2 + 9s}$.

Problem 4: Consider the mechanical system shown below. Using the force-current analogy to derive an *analogous* electrical circuit. Show the resulting circuit diagram.



Problem 5: Consider the electrical circuit shown below, obtain the response $e_o(t)$ when a step input $e_i(t) = 5\,V$ is applied to the system. Assume that $R_1 = 1M\ \Omega$, $R_2 = 0.5M\ \Omega$, $C_1 = 0.5\mu\ F$ and $C_2 = 0.1\mu\ F$. Assume also that capacitors are not charged initially.