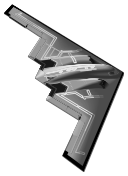
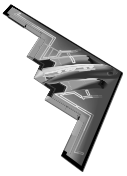
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING



ECEN 3723 Systems I
Fall 2008
Final Exam
December 9, 2008

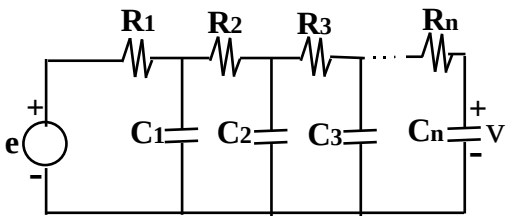


Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;

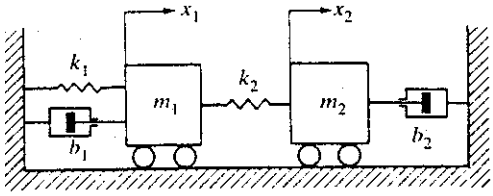
Name : _____

E-Mail Address:_____

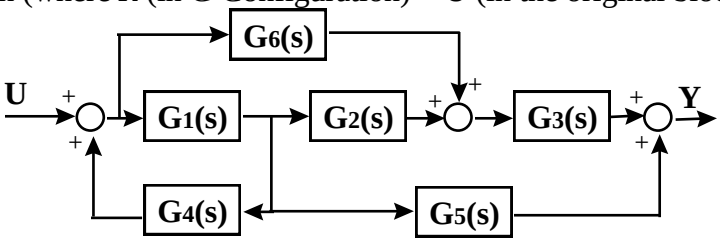
Problem 1: Derive the transfer function $V(s)/E(s)$ for the given RC ladder circuit given below where *e* is the input source and *V* is the output response (note $R_1 \neq R_2 \neq \cdots \neq R_n$ and $C_1 \neq C_2 \neq \cdots \neq C_n$).



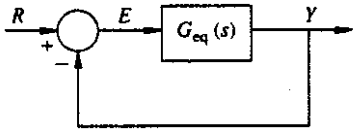
Problem 2: Obtain an *analogous* electrical circuits (using force-current analogy) for the mechanical system shown below.



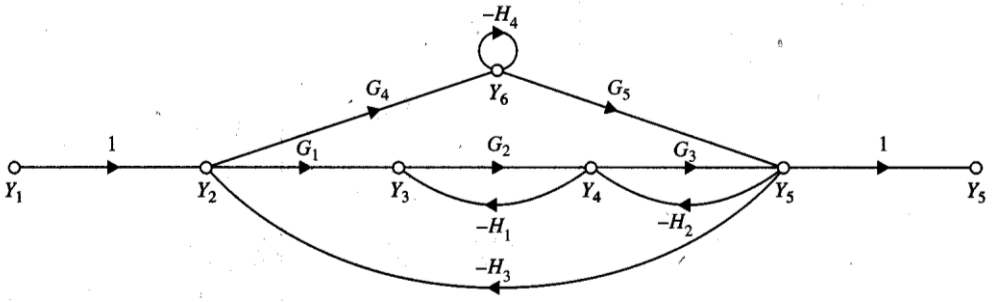
Problem 3: Using the block diagram reduction technique, find the plant transfer function $G_{eq}(s)$ in the G-configuration (where R (in G Configuration) = U (in the original block diagram)).



G Configuration



Problem 4: Apply the gain formula to the SFG shown below to find the transfer functions of $\frac{Y_5}{Y_1}$ and $\frac{Y_5}{Y_2}$.



Problem 5: The block diagram of a feedback control system is shown below.

a) Derive the transfer functions of $\left.\frac{Y(s)}{R(s)}\right|_{N=0}$, $\left.\frac{Y(s)}{N(s)}\right|_{R=0}$.

b) The controller with the transfer function $G_4(s)$ is for the reduction of the effect of the noise $N(s)$. Find $G_4(s)$ so that the output $Y(s)$ is totally independent of $N(s)$.