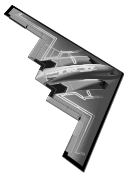
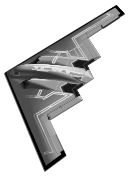
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING



ECEN 3723 Systems Dynamics
Fall 2012
Midterm Exam #2
November 8, 2012

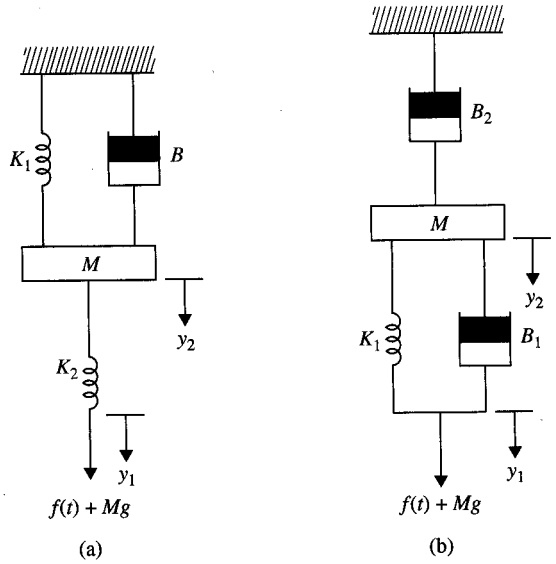


Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;

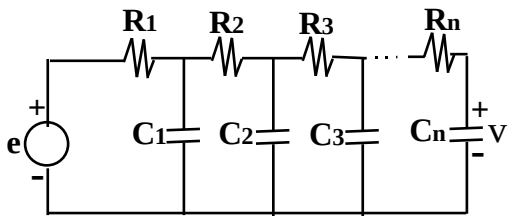
Name : _____

E-Mail Address:_____

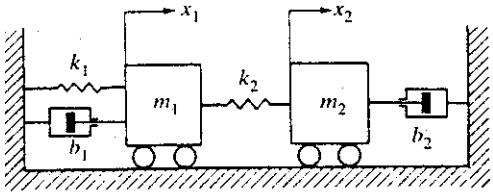
Problem 1: Derive the equations of motion for both mechanical systems (a) and (b) shown below.



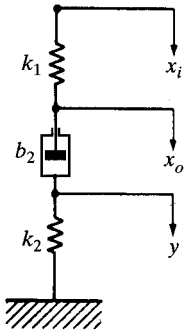
Problem 2: Derive the transfer function $V(s)/E(s)$ for the given RC ladder circuit given below where $e(t)$ is the input source and $v(t)$ is the output response (note $R_1 \neq R_2 \neq \cdots \neq R_n$ and $C_1 \neq C_2 \neq \cdots \neq C_n$).



Problem 3: Obtain an *analogous* electrical circuits (using force-current analogy) for the mechanical system shown below.



Problem 4: Derive the transfer function $\frac{X_o(s)}{X_i(s)}$ of the mechanical system shown below. Assume that $x_o(0–) = 0$ and $y(0–) = 0$.



Problem 5: The mechanical system shown below is at rest initially. At $t = 0$, a unit-step displacement input is applied to point *A* (i.e., $y(t) = u(t)$). Assuming that the system remains linear throughout the response period and is *overdamped*, determine the response $x(t)$ as well as the values of $x(0+)$ and steady state $x(\infty)$.