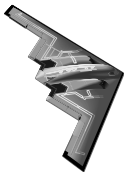
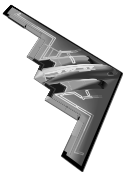
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING



ECEN/MAE 3723 Systems I
Fall 2006
Midterm Exam #2
November 21, 2006



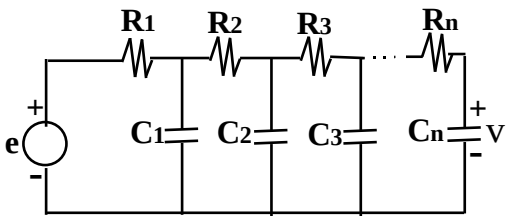
Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;

Name : _____

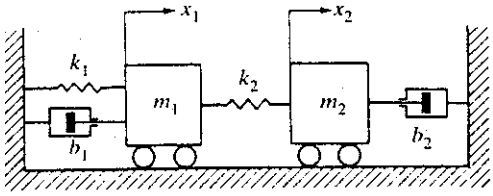
Student ID: _____

E-Mail Address:_____

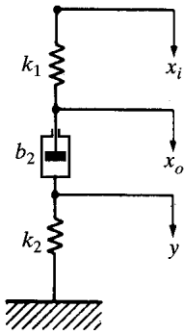
Problem 1: Derive the transfer function $V(s)/E(s)$ for the given RC ladder circuit given below where *e* is the input source and *V* is the output response (note $R_1 \neq R_2 \neq \cdots \neq R_n$ and $C_1 \neq C_2 \neq \cdots \neq C_n$)..



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



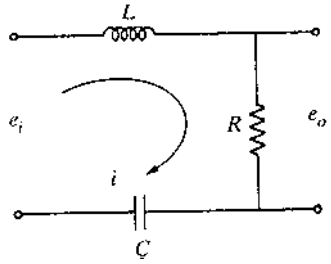
Problem 3: Derive the transfer function $\frac{X_o(s)}{X_i(s)}$ of the mechanical system shown below. Then obtain he response $x_o(t)$ when the input $x_i(t)$ is a pulse signal given by $x_i(t) = \begin{cases} X_i, & 0 < t < t_1 \\ 0, & \text{elsewhere} \end{cases}$. Assume that $x_o(0-) = 0$.



Problem 4: Consider the electrical circuits shown below. Assume that the input is sinusoidal,

$e_i(t) = E_i \cos \omega t$,

what is the steady state current $i(t)$? Please derive the formula fopr steady state response when the system is subject to an input of $E_i \cos \omega t$.



Problem 5: Consider the mechanical vibratory system shown below. Assume that displacement x is measured from the equilibrium position in the absence of the sinusoidal excitation force. The initial conditions are $x(0) = 0$ and $\dot{x}(0) = 0$, and the input force $p(t) = P\sin\omega t$ is given at $t = 0$. The numerical values are given as m = 2 kg, b = 24 N-s/m, k = 200 N/m, P = 5 N and ω = 6 rad/s. Obtain the complete solution $x(t)$.