OKLAHOMA STATE UNIVERSITY

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

**ECEN 3723 Systems I
Spring 2001
Final Exam**

choose four out of five problems: please indicate as below.
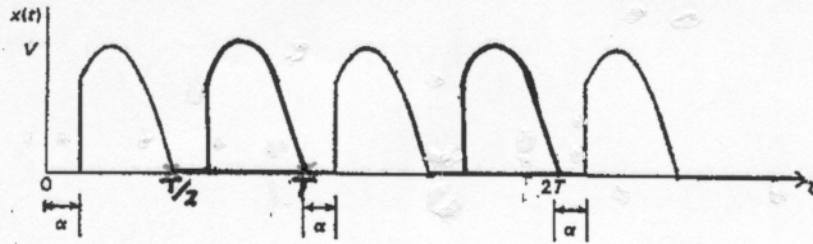
1).____   2).____   3).____   4).____

Name : _____

Student ID: _____

E-Mail Address: _____

Problem 1: (*Laplace Transform*)

Determine the Laplace transform of the following signal, $x(t)$, with five periods shown below.

Problem 2: (*z Transform*)

A linear time-invariant discrete-time system is given by the input/output difference equation
$$y(k) + y(k-1) - 2y(k-2) = 2x(k) - x(k-1).$$

Find an input $x(k)$ with $x(k) = 0$, $k < 0$ that gives the output response

$y(k) = 2(u(k) - u(k-3))$ with initial conditions $y[-2] = 2$, $y[-1] = 0$.

Problem 3: (*Time Response*)

Consider the mechanical system shown below. Determine the response function $x(t)$ versus t when mass m is pulled slightly downward, generating the initial conditions $x(0) = 0.05$ m and $\dot{x}(0) = 1$ m/s. The displacement x is measured from the equilibrium position before mass m is pulled downward. Assume that $m = 1$ kg, $k_1 = 6$ N/m, $k_2 = 10$ N/m, $b_1 = 4$ N-s/m.
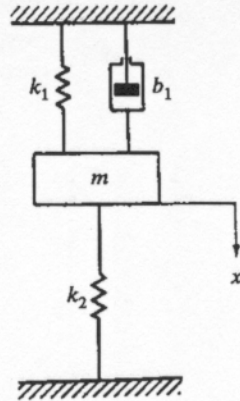
Problem 4: (*Frequency Response*)

Consider the electrical circuits shown beloew. Assume that the input is sinusoidal, $e_i(t) = E_i \cos \omega t$, what is the steady state output voltage $e_o(t)$?
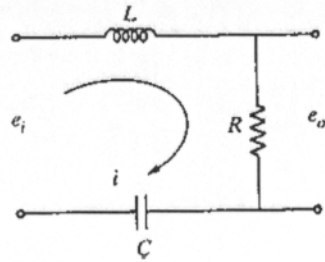
Problem 5: (*Block Diagram Reduction*)

Find the closed-loop transfer function of an aircraft system shown below, $\dfrac{\Theta_y(s)}{\Theta_r(s)}$.