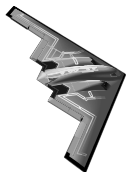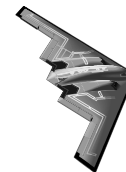# OKLAHOMA STATE UNIVERSITY

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECEN 3723 Systems I
Spring 2002

Final Exam

Choose any four out of five problems,
Please specify
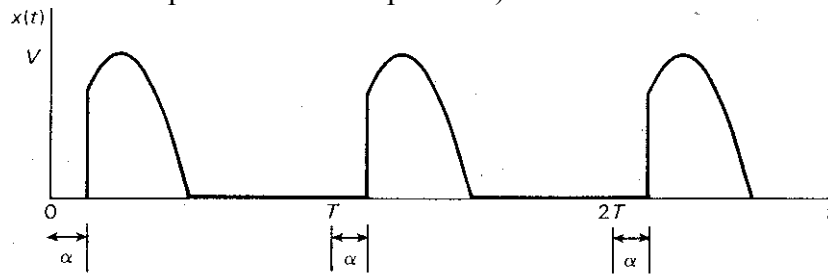1)_____; 2)_____; 3)_____; 4)_____;

Name : _____

Student ID: _____

E-Mail Address:_____

Problem 1:

Determine the Laplace transform of the following signal, $x(t)$, with only *five* periods (cycles). (Note that the maximum amplitude is V with period T)

Problem 2:

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 produces the output

response $y(k) = 2\big(u(k) - u(k-3)\big)$ with initial conditions $y[-2] = 2, y[-1] = 0$.
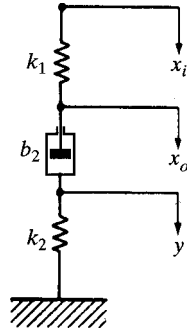
Problem 3:

Derive the transfer function $\dfrac{X_o(s)}{X_i(s)}$ 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

$$x_i(t) = \begin{cases} X_i, & 0 < t < t_1 \\ 0, & \text{elsewhere} \end{cases}.$$
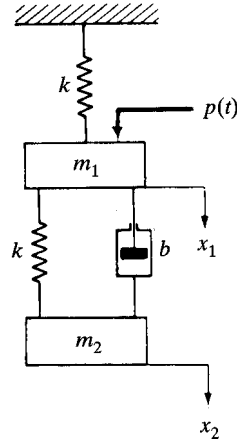
Assume that $x_o(0-) = 0$.

Problem 4:

Consider the mechanical system shown below. Obtain the steady state outputs $x_1(t)$ and $x_2(t)$ when the input $p(t)$ is a sinusoidal force given by

$p(t) = P \sin \omega t$.

The output displacements $x_1(t)$ and $x_2(t)$ are measured from the respective equilibrium positions.

Problem 5:

Simplify the block diagram shown below and obtain the closed-loop transfer function $\dfrac{C(s)}{R(s)}$.