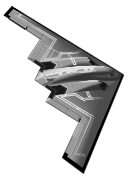
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING



ECEN/MAE 3723 Systems I
Fall 2004
Midterm Exam #1
October 14, 2004

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

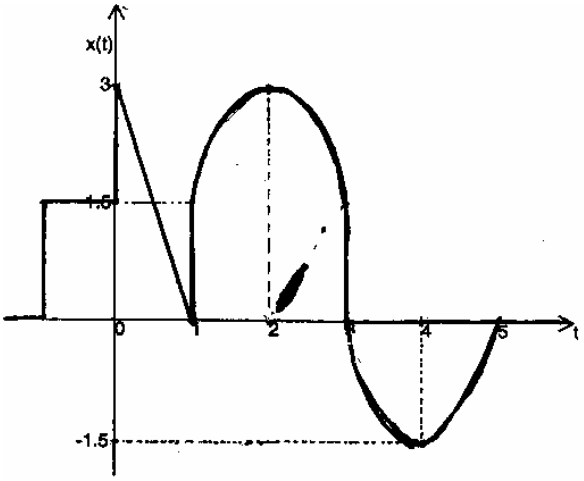
Name : _____

Student ID: _____

E-Mail Address:_____

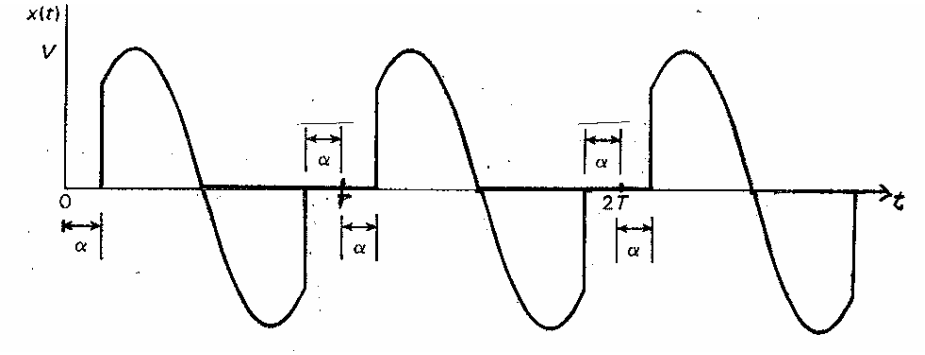
Problem 1:

Describe the following signal, $x(t)$, in terms of some basis functions (e.g., unit step $u(t)$, unit impulse $\delta(t)$, unit ramp $r(t)$, or sinusoidal).



Problem 2:

Determine the Laplace transform of the following signal, $x(t)$, with twenty periods (cycles). Express your answer in a closed form.



Problem 3:
Find the Inverse Laplace transforms of

$$X(s) = e^{-4s} \ln \frac{s+a}{s+b}.$$

Problem 4:

A continuous-time signal

$$x(t) = e^{-2t} \sin 3t u(t)$$

has the Laplace transform $X(s)$. Determine the inverse Laplace transform of $V(s)$, $v(t)$, where

$$V(s) = \frac{e^{-5s} + e^{5s}}{2} X(s).$$

Problem 5:

For the linear time-invariant system described by an ordinary differential equation

$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 13y(t) = -5\frac{dx(t)}{dt} + 6x(t),$$

given input is $x(t) = e^{-4t}u(t)$. Note that $y(t)$ is the output response and $x(t)$ is the input signal.

Find the initial conditions $y(0),\ \dot{y}(0) = \left.\frac{dy(t)}{dt}\right|_{t=0}$ such

that $y(t) = ((\sin 3t + \cos 3t)e^{-2t} + 2e^{-4t})u(t)$.