ECEN/MAE 3723 Systems I
Fall 2006
Midterm Exam #1
October 5, 2006

Choose any four out of five problems.
*Please specify which four listed below to be graded:*
1)_____; 2)_____; 3)_____; 4)_____; 5)_____;

Name: ________________________________

E-Mail Address: ________________________________
Problem 1:
Describe the following signal, \( x(t) \), in terms of some basis functions (e.g., step, impulse, ramp or sinusoidal):
Problem 2:
Find the Laplace transform of
\[ \int_{0}^{t} \lambda e^{-3\lambda} \sin(\omega \lambda - \theta) d\lambda \]
Problem 3:
Find the Inverse Laplace transforms of
\[
\int_{s}^{\infty} \frac{(1 - e^{-4\xi})\xi^2}{\xi^2 + 2\xi} \, d\xi.
\]
Problem 4:
Determine the Laplace transform of the following signal, $x(t)$, with five periods (only three periods are shown in the graph).
Problem 5:
Solving the linear time-invariant ordinary differential equation
\[
\frac{d^2 y(t)}{dt^2} + 4 \frac{dy(t)}{dt} + 13y(t) = -5 \frac{dx(t)}{dt} + 6x(t),
\]
with initial conditions and input \( y(0) = 3, \frac{dy(t)}{dt} \bigg|_{t=0} = -2, x(t) = e^{-4t}u(t) \), where \( y(t) \) is the output response and \( x(t) \) is the input signal. Find \( y(t) \) and \( \lim_{{t \to \infty}} y(t) \) via final value theorem.