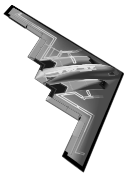
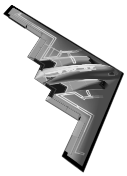
O K L A H O M A S T A T E U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING



ECEN 3723 Systems I
Spring 2003

Midterm Exam #1



DO ALL FIVE PROBLEMS

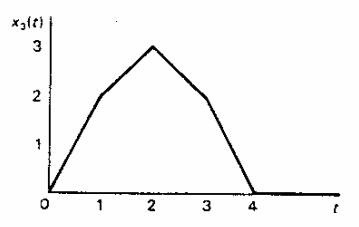
Name : _____

Student ID: _____

E-Mail Address:_____

Problem 1: (*Signal Representation*)

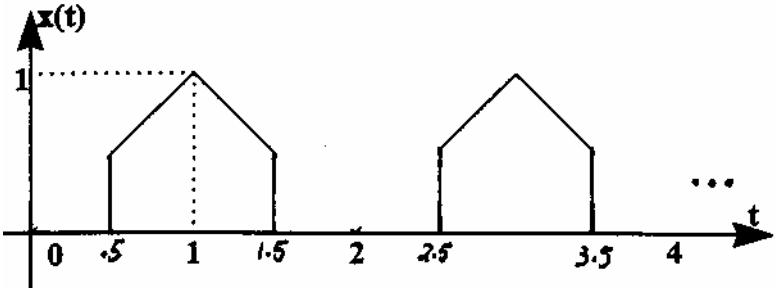
Make a labeled sketch of the $y(t) = -x(3-3t) + 0.5x(\frac{t}{2} - 1)$, where $x(t)$ is given below.



Problem 2: (*Laplace Transform*)
Find the Laplace transforms of

a) $\int_0^t e^{-2\lambda}\cos(\omega\lambda+\theta)d\lambda$, and

b) $x(t)$ with five periods (only two periods are shown in the graph).

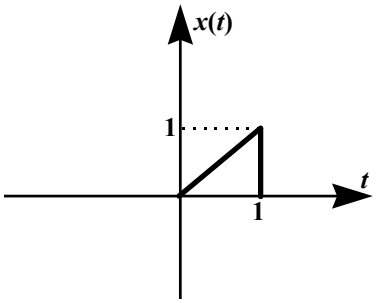


Problem 3: (*Inverse Laplace Transform*)
Find the Inverse Laplace transforms of

a) $\dfrac{s^2}{s^2 + 2as + b}$, and

b) $e^{-4s} \ln \dfrac{s+a}{s+b}$.

Problem 4: (*Solution of Differential Equation*)
Consider a filtered circuit that the output response, $y(t)$, is the time-convolution of the input signal, $x(t)$, and the impulse response, $h(t)$, of the system where $h(t) = e^{-2t}u(t)$ (i.e., $y(t) = \int_0^t x(\tau)h(t-\tau)d\tau$). x(t) is graphically given as



Determine $y(t)$ and find the transfer function of the system, $H(s)$.

Problem 5: (*Transfer Function*)
A continuous-time system is defined by the following differential equation

$$\frac{d^2y(t)}{dt^2} + 5\frac{d^2x(t)}{dt^2} - \frac{dy(t)}{dt} + 3y(t) - 2x(t) = 0,$$

where $x(t)$ is the input and $y(t)$ is the output of the system. Find its equivalent representation in transfer function, $H(s) = \frac{Y(s)}{X(s)} = \frac{\mathcal{L}(y(t))}{\mathcal{L}(x(t))}$.