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

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECEN 3723 Systems I
Fall 2000
Final Exam

DO ALL FIVE PROBLEMS

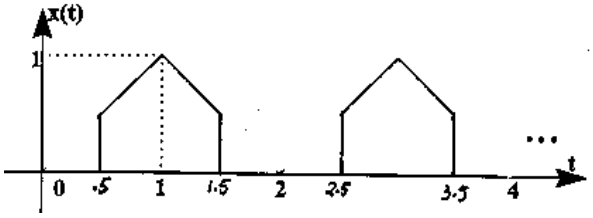
Name : _____

Student ID: _____

E-Mail Address:_____

Problem 1: (*Laplace Transform*)

Determine the Laplace transform of the following signal, $x(t)$, with five periods (only two periods are shown in the graph).



Problem 2: (*z Transform*)

A linear time-invariant discrete-time system has transfer function

$$H(z) = \frac{3z}{z^2 - 0.25}.$$

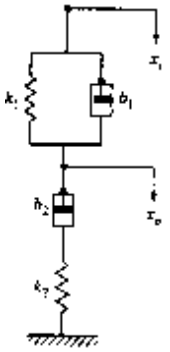
The output response resulting from the input $x(k) = u(k)$ and initial conditions $y[-1]$ and $y[-2]$ is

$$y(k) = \left[(0.5)^k - 3(-0.5)^k + 4\right] u(k).$$

Determine the initial conditions $y[-1]$ and $y[-2]$, and the part of the output response due to the initial conditions.

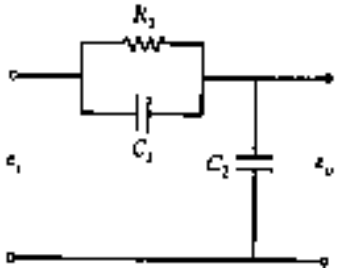
Problem 3: (*Time Response*)

Consider the mechanical system shown below, where $k_1 = 1\,\text{N/m}$, $k_2 = 2\,\text{N/m}$, $b_1 = 0.5\,\text{N-s/m}$, and $b_2 = 1\,\text{N-s/m}$. Obtain the response $x_o(t)$ when $x_i(t)$ is a unit-step displacement input.



Problem 4: (*Frequency Response*)

Consider the electrical circuits shown beloew. Assume that the input is sinusoidal, $e_i(t) = E_i \sin\omega t$, what is the steady state output voltage $e_o(t)$?



Problem 5: (*Block Diagram Reduction*)

Find the closed-loop transfer function of the system shown below, $\frac{Y(s)}{R(s)}$.