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

S C H O O L O F E L E C T R I C A L A N D C O M P U T E R E N G I N E E R I N G
S C H O O L O F M E C H A N I C A L A N D A E R O S P A C E E N G I N E E R I N G

ECEN 4413/MAE 4053
Automatic Control Systems
Spring 2012

Midterm Exam #1

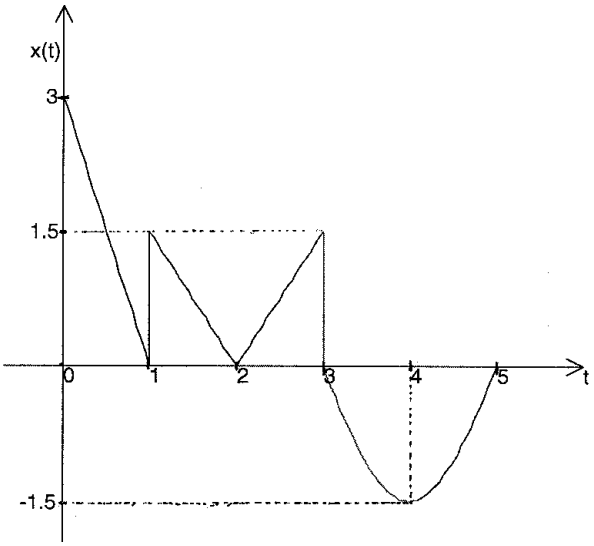
Choose any four out of five problems.
Please specify which four listed below to be graded:
_____; _____; _____; _____.
If you do not specify which four, the worst four will be chosen.

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:

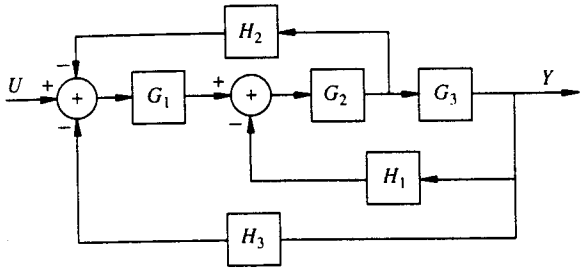
A continuous-time system is described by the transfer function given below

$$H(s) = \frac{Y(s)}{X(s)} = \frac{-5s^2 + 2}{s^2 - s + 3},$$

where $x(t)$ is the input and $y(t)$ is the output of the system. Compute the response, $y(t)$, for all $t \geq 0$, when $y(0^-) = -2$, $\dot{y}(0^-) = 1$, and $x(t) = r(t) = tu(t)$.

Problem 3:

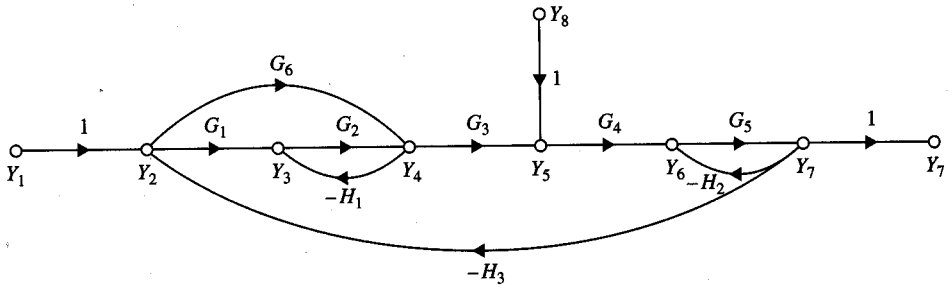
Using the Block Diagram Reduction technique to derive the close-loop transfer function of $\frac{Y(s)}{U(s)}$.



Problem 4:

Find the following transfer functions for the SFG shown below:

a) $\left.\frac{Y_7}{Y_1}\right|_{Y_8=0}$ and b) $\left.\frac{Y_7}{Y_4}\right|_{Y_1=0}$.



Problem 5:

A continuous-time signal

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

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

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