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

ECEN 4413 Controls II
Fall 1997
Midterm Exam #1

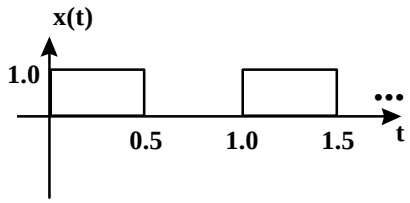
Name : _____

Student ID: _____

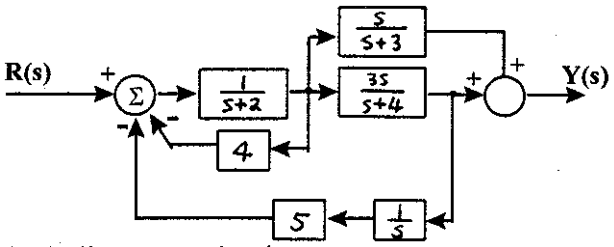
E-Mail Address:_____

Problem 1:

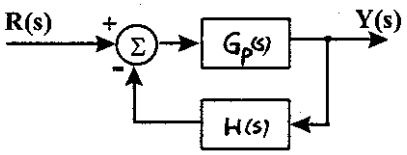
Find the Laplace transform of the periodic waveform, $x(t)$, shown below.



Problem 2:



Use block diagram reduction to rearrange the above block diagram into the form shown below (i.e., H configuration) and find its transfer function, $\frac{Y(s)}{R(s)}$.



Problem 3:

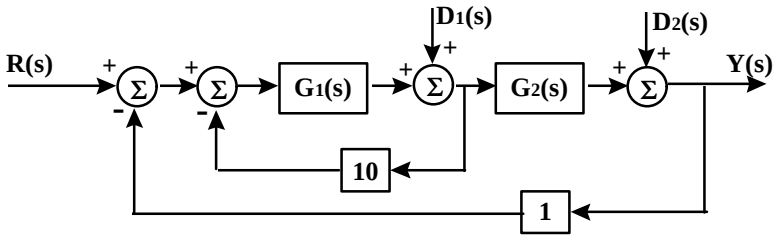
For the state variable description,

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 0 & 1 \end{bmatrix} x(t)$$

if $u(t) = e^{-3t} u_s(t)$, where $u_s(t)$ is the unit step function and initial conditions are all zeros, find $y(t)$.

Problem 4:



Given feedback system shown above, determine the sensitivity of the closed-loop transfer function, $M_c(s)$ with respect to $G_1(s)$ and $G_2(s)$ (i.e., $S_{G_1(s)}^{M_c(s)}$ and $S_{G_2(s)}^{M_c(s)}$) . And determine the effects on disturbance rejections (i.e., $\frac{Y(s)}{D_1(s)}$ and $\frac{Y(s)}{D_2(s)}$).