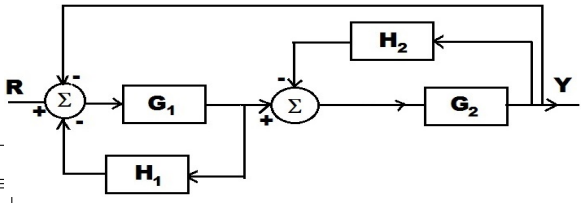
Name:
ID. No.

Eskişehir Osmangazi University - Electrical Engineering Department
Fundamentals of Control Systems
Midterm Examination - Summer 2014

All answers must be written in the appropriate neighborhoods of the questions. Anything written elsewhere will not be graded. Use the back side of the exam sheet if you need scratch paper.

Question 1.

[30 pts.] Let $G_1(s) = 1$, $G_2(s) = \frac{1}{s}$, $H_1(s) = \frac{1}{s+1}$ *and* $H_2(s) = \frac{1}{s+2}$. *Obtain the transfer function* $\frac{Y(s)}{R(s)}$. *Fill all the boxes below.*



$$\frac{Y(s)}{R(s)} = \frac{\boxed{0}\,s^4 + \boxed{0}\,s^3 + \boxed{1}\,s^2 + \boxed{3}\,s + \boxed{2}}{\boxed{0}\,s^4 + \boxed{1}\,s^3 + \boxed{5}\,s^2 + \boxed{8}\,s + \boxed{4}}$$

Question 2.

(a) [20 pts] Given $\dot{x}_1 = 3x_1 + u$, $\dot{x}_2 = 2x_1$, $y = x_1$, $x_1(0) = 0$ $x_2(0) = 4$ *and* u *is a unit step function. Find* $y(t)$.

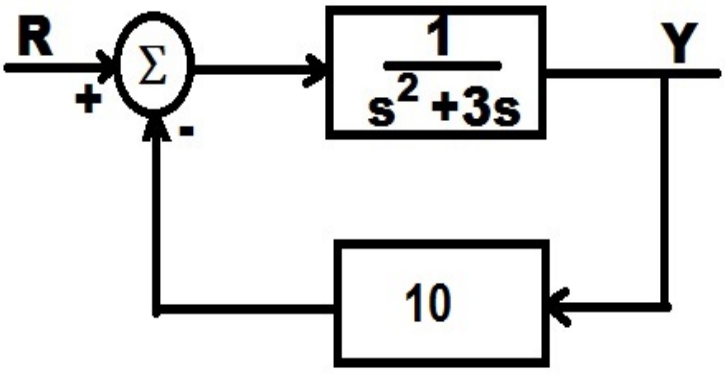
$$y(t) = \frac{1}{3}e^{3t} - \frac{1}{3},\ t \geq 0$$

(b) [15 pts] Find the transfer function $\frac{Y(s)}{U(s)}$. *Fill all the boxes below.*

$$\frac{Y(s)}{U(s)} = \frac{\boxed{0}\,s^4 + \boxed{0}\,s^3 + \boxed{0}\,s^2 + \boxed{0}\,s + \boxed{1}}{\boxed{0}\,s^4 + \boxed{0}\,s^3 + \boxed{0}\,s^2 + \boxed{1}\,s + \boxed{-3}}$$

Question 3.

[35 pts.] Given that $r(t)$ *is a step function with amplitude* 5, *find (a) the rise time, (b) the peak time, and (c) the peak value of* y.



$t_r = 0.74$

$t_p = 1.13$

$y_p = 0.59$

Good Luck
A. Karamancıoğlu