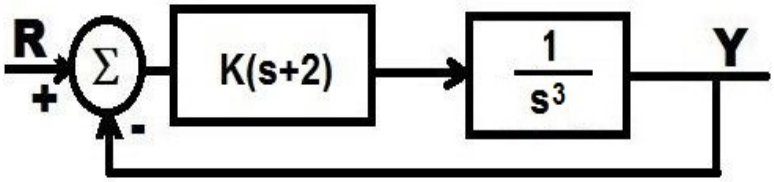
Name:
ID. No.

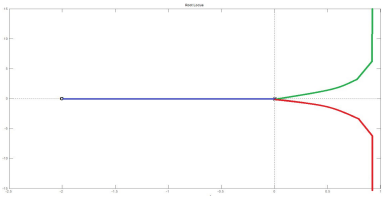
Eskişehir Osmangazi University - Electrical Engineering Department
Fundamentals of Control Systems
Final Examination - Summer 2014

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.

(a) 15 pts.Sketch the root loci for the configuration below. Show trajectory directions by arrows.
(b) 5 pts. Is this system stable for $K = 5$?
(c) 5 pts. Find K value corresponding to the closed loop pole $s = -1$.

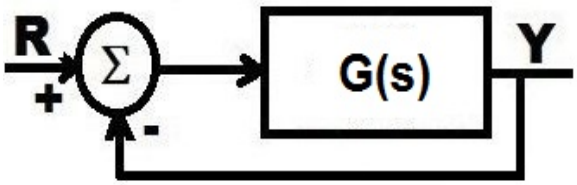


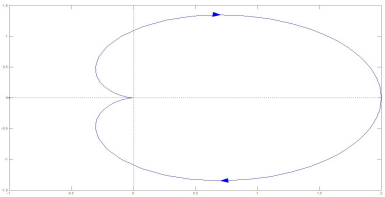


(b) No (c) K=1

Question 2.

Let $G(s) = \frac{s+2}{(s+1)^3}$.
(a) 10 pts. Sketch the Nyquist plot for the configuration below.
(b) 5 pts. Find the imaginary axis crossing points of the sketch (10% error is acceptable).
(c) 5 pts. How many times is the (-1,0) encircled in the $G(s)$ plane?
(d) 5 pts. Is this system stable?

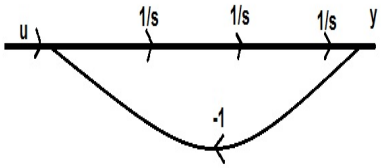




(b) $\pm i1.09$ (c) 0 (d) Yes

Question 3.

25 pts. Sketch a realization of the transfer function $\frac{Y(s)}{U(s)} = \frac{1}{s^3+1}$ using adders, gains, and integrators.



Question 4.

Consider the difference equation
$y_{n+1} = -3y_n + x_n$.
(a) 15 pts. Find the transfer function $\frac{Y(z)}{X(z)}$.
(b) 5 pts. Is this system stable?
(c) 5 pts. For the initial condition $y_0 = 0$ and x_n equals the discrete impulse function, calculate y_1, y_2, y_3, and y_4.

(a) $\frac{Y(z)}{X(z)} = \frac{1}{z+3}$ (b) No
(c) $(1, -3, 9, -27)$

Good Luck
A. Karamancıoğlu