Osmangazi University - Electrical Engineering Department Fundamentals of Control Systems Final Examination - Spring 2005

Let C(s) = K be a constant gain and $H(s) = \frac{1}{(s+2)(s+4)(s+6)}$ as depicted in Figure 1.

1) (10 pts.) Write the closed loop transfer function T(s)

2) (30 pts.) Sketch the root locus of the system.

3) (30 pts.) For which values of K is the closed loop system stable?

4) (30 pts.) Sketch the Nyquist plot for the system depicted in Figure 1 for

K = 200. Comment on the closed loop stability of the system.



Figure 1: System referenced by the problems 1-4

Good Luck, A. Karamancıoğlu



Figure 2: The root locus

3)

$$s^{3} 1 44 s^{2} 12 48 + K s^{1} \frac{12 \times 44 - 48 - K}{12} s^{0} 48 + K$$

Stability requires -48 < K < 480

4) It is stable, because the Nyquist plot does not encircle the critical point -1



Figure 3: The Nyquist plot

(note also that the open loop loop system does not have pole in the Nyquist contour).

2)