# Eskişehir Osmangazi University - Electrical Engineering Department Fundamentals of Control Systems Final Examination - Spring 2017

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. Duration: 75 min., Calculator is allowed, An A4 size sheet (both sides for any content) is allowed.

## Question 1.



(b) [10p] How many poles does this transfer function have in the open left half plane?

## Question 2.

Sketch the root locations of the closed loop system as K changes from 0 to  $\infty$ . Find the break away and imaginary axis crossing points if they exist (10% error is tolerable)





### Question 3.

(a) [15p] Write the transfer function  $\frac{Y(z)}{U(z)}$  corresponding to the difference equation

 $y_m = -2.1y_{m-1} - 0.2y_{m-2} + u_m$ 

in the form  $\frac{a_m z^m + a_{m-1} z^{m-1} \dots + a_0}{b_n z_n + b_{n-1} z^{n-1} + \dots + b_0}$  Ans.  $\frac{z^2}{z^2 + 2.1z + 0.2}$ (b) [10p] Is this difference equation BIBO stable? Ans. No

### Question 4.

(a) [20p] Sketch the Nyquist plot for the system given below. Show values of the axis crossing points if they exist.



(b)[5p] Is this system stable? Ans. Yes

