

Quiz - 2 (20 marks)

1. Sketch the root locus for the control system shown in Figure 1. Follow all the 8 steps

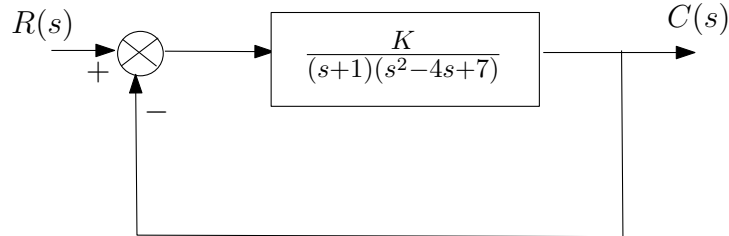


Figure 1: Control System

clearly. Indicate as well the gain values wherever required.

(8 marks)

2. a) Sketch the polar plot of the transfer function $G(s) = \frac{e^{-s}e^{-i\frac{\pi}{2}}}{s+1}$. (4 marks)
- b) An LTI system is described by $\frac{d^2c(t)}{dt^2} - \frac{dc(t)}{dt} = \frac{dr(t)}{dt} + r(t)$, where $r(t)$ is the input and $c(t)$ is the output of the system. Sketch the polar plot. (4 marks)

Label the polar plot and indicate directions wherever necessary.

3. Consider the following non-unity feedback system with disturbance input as shown in Figure 2.

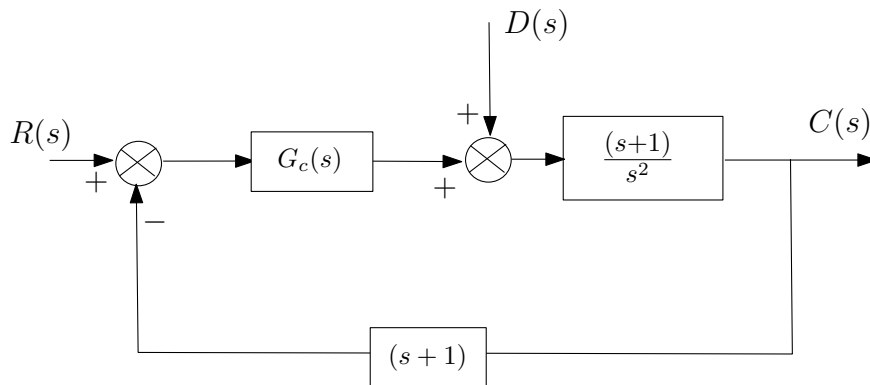


Figure 2: System with input and disturbance

Consider the proportional and integral controller $G_c(s) = K_P + \frac{K_I}{s}$. Assuming $R(s) = 0$ and $D(s) = 1/s$, the unit-step signal, calculate the steady-state error due to disturbance. Clearly, mention if any further assumptions are need to be imposed on the parameters of the PI controller. (4 marks)