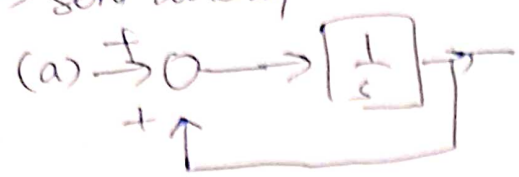
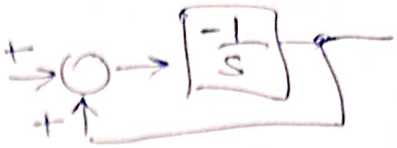
Tut sheet 4 : EE 302 - Sp brief solutions

Qn-1, 2 → sent already.

Q-3 :

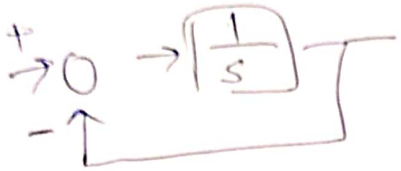


closed loop unstable



closed loop stable.

Q-4 :



closed loop stable.

unstable (closed loop)

Q-5

$\frac{1}{s+1}$ (a)

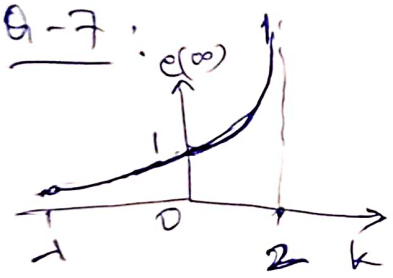
$\frac{s-1}{s+2}$ (b) (root locus goes to zero ↓ ∈ RHP)

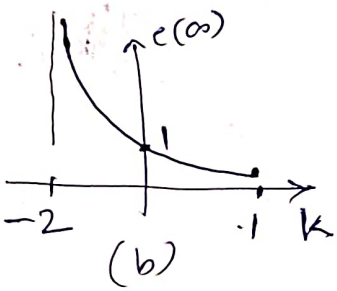
Q-6 :

$\frac{1}{s+1}$ (a)

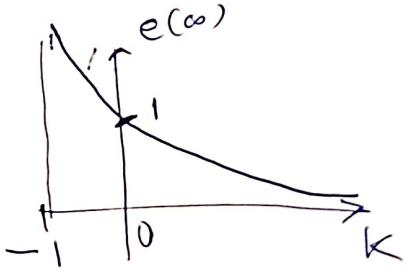
$\frac{s+1}{s+5}$ (b).

Q-7 :

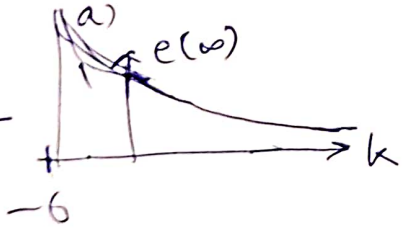




(b)



Q-8



settling time is $\frac{4}{1.5}$ seconds whereas closed loop poles are nonreal.

Q-9 → Use cloud.scilab.in to plot & check. (use $-n(s)$ for $k<0$).

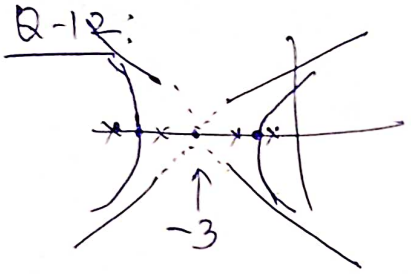
Q-10 ↗

Q-11 : Same to pole/zero real & interlaced, only real axis segments (either $k<0$ or $k>0$) applies to this $G(s)$.

even rule

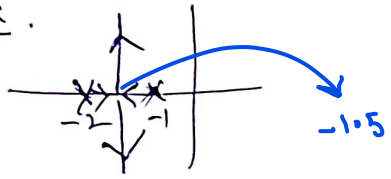
odd rule

Q-12:



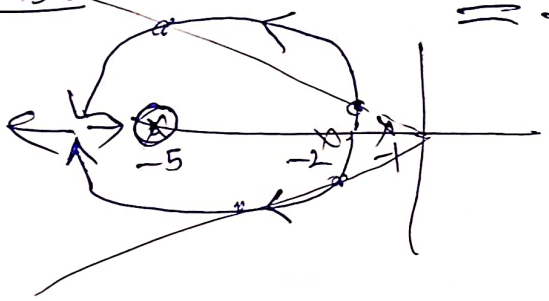
Use Scilab for a ($k>0$)
& $-a$ (for $k<0$).

Q-13 a.



Settling time (for closed loop underdamped)
$= \frac{4}{1.5}$ seconds. no choice
$\approx 2.66 s$ (whatever %05)
So <2 seconds not possible.

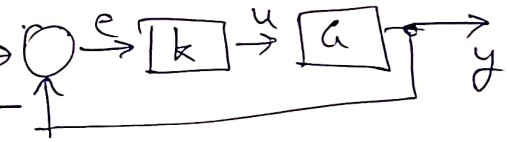
Q-13 b



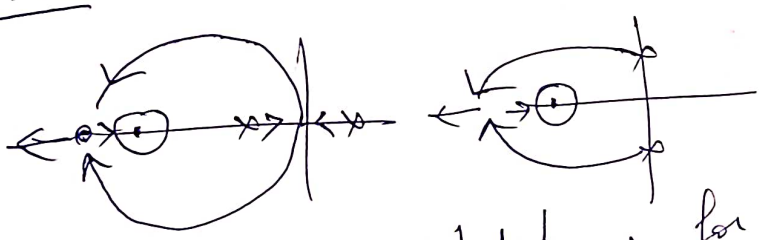
Now less than 2 % settling time is possible, for 2 values of k.

Q-14. cannot stabilize using only proportional gain control since root locus has always one (atleast) s branch in Closed Rt HP.

$u = ke$ in



Q-15



can stabilize: for k large (for $\frac{s+2}{s^2-1}$)
or $k>0$ (for $\frac{s+2}{s^2+1}$) both closed loop poles in OLHP.

Q-16:

(a) $\frac{s-2}{(s+1)(s+3)}$

(b) $\frac{1}{(s+1)^3}$ or $\frac{1}{(s+1)(s+2)(s+3)}$

will go (atleast unstable one pole in CRHP) for large k.