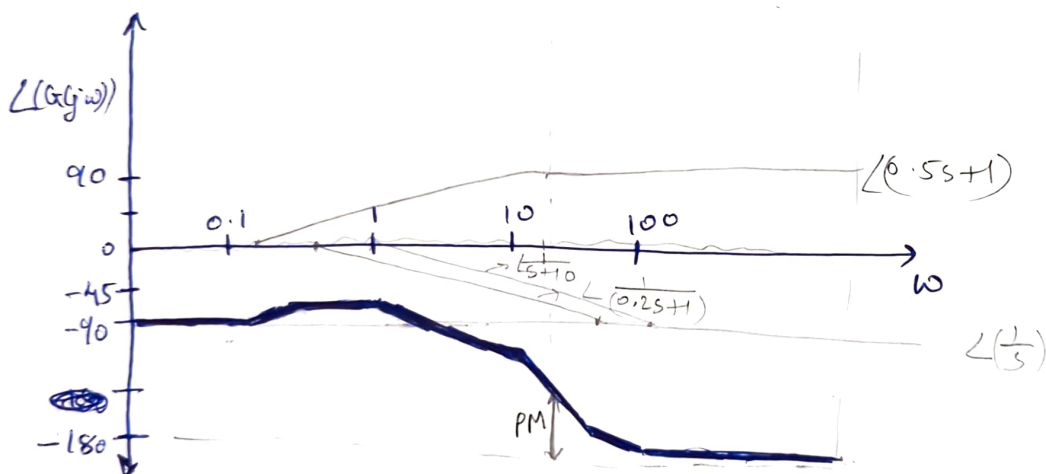
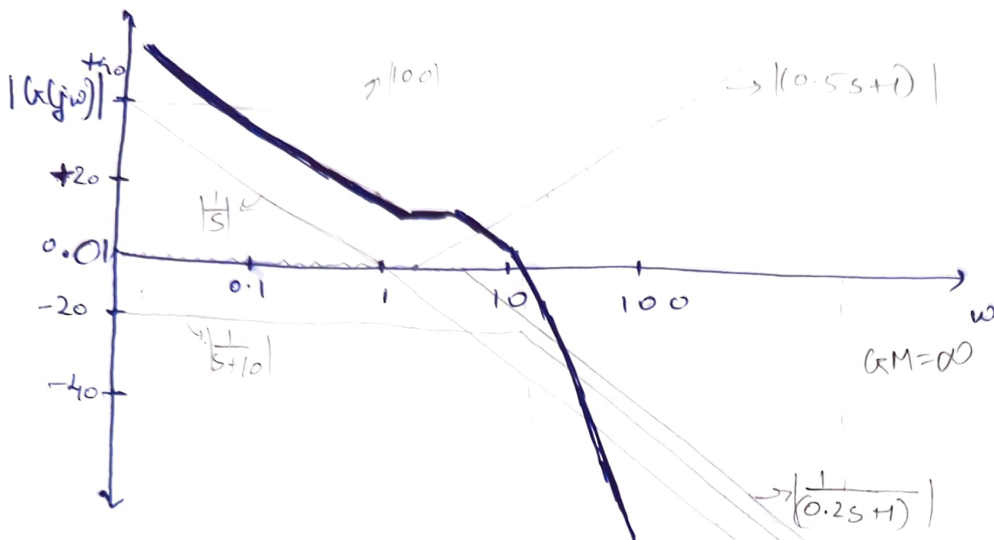


Q1 (a)

$$L(s) = \frac{100(0.5s+1)}{s(0.2s+1)(s+10)}$$

Collaborated with  
→ Ruchita Sinha  
→ Aditya Rathi



(b)  
For gain margin,  
the phase plot asymptotically  
reaches  $-180^\circ$  at  $\omega = \infty$ .  
Gain at  $\omega = 0, = \infty$   
 $\therefore GM = \infty$

For phase margin,  
the cross-over frequency  
is slightly  $> 10$ ,

In the phase plot,  
we have a slope of  
 $-45^\circ/\text{dec}$  between  $\omega=1, 10$   
and  $-90^\circ/\text{dec}$  just after  
 $\omega=10$ ,

The phase then at  
cross-over frequency  
would be  $\sim -135^\circ$   
 $\therefore PM = |-180^\circ - (-135^\circ)|$   
 $= 45^\circ$

(c) Delay Margin  
 $= \frac{PM}{\omega_c} = \frac{45 \times 2\pi}{15 \times 180}$   
 $\neq 2$  seconds  
 $= \frac{\pi}{30}$  seconds

