Question 1

Consider the following systems, $G(s)$:

1. \( \frac{10}{(s+1)(s+10)} \)
2. \( \frac{1}{(s+1)(s-2)} \)
3. \( \frac{1}{s^2+s+1} \)
4. \( \frac{1}{s(s+1)} \)

Find the suitable values for the parameters of a member of the PID family to control each of these models (For direct synthesis, use $\tau_c = 1$).

Question 2

Consider the model

\[
G(s) = \frac{(-\alpha s + 1)}{(s + 1)(s + 2)}
\]  \hspace{1cm} (1)

Use direct synthesis to design a PID controller $\tau_c = 0.5$. Compute the complementary sensitivity function. Comment on the servo-response of the closed-loop system for $\alpha$ in the interval $[0.1; 20]$.

Question 3

Consider a plant with nominal model

\[
G(s) = \frac{-s + 3}{(s + 3)(s + 5)}
\]  \hspace{1cm} (2)

- Using direct synthesis, synthesize a PID controller for this system, with $\tau_c = 0.1$.
- Compute the complementary sensitivity function. Comment on the servo-response of the closed-loop system.