1. Using the Routh-Hurwiz criterion, **(20%)**

10% **(1) determine the stability of the closed-loop system that has the characteristic equation**

$$q(s)=s^6+s^5+11s^4+5s^3+36s^2+6s+36=0$$

10% **(2)determine the number of roots of the above equation that are in the**

(a) left-half s-plane ,

(b) on the $j\omega$-axis and

(c) in the right-half s-plane.

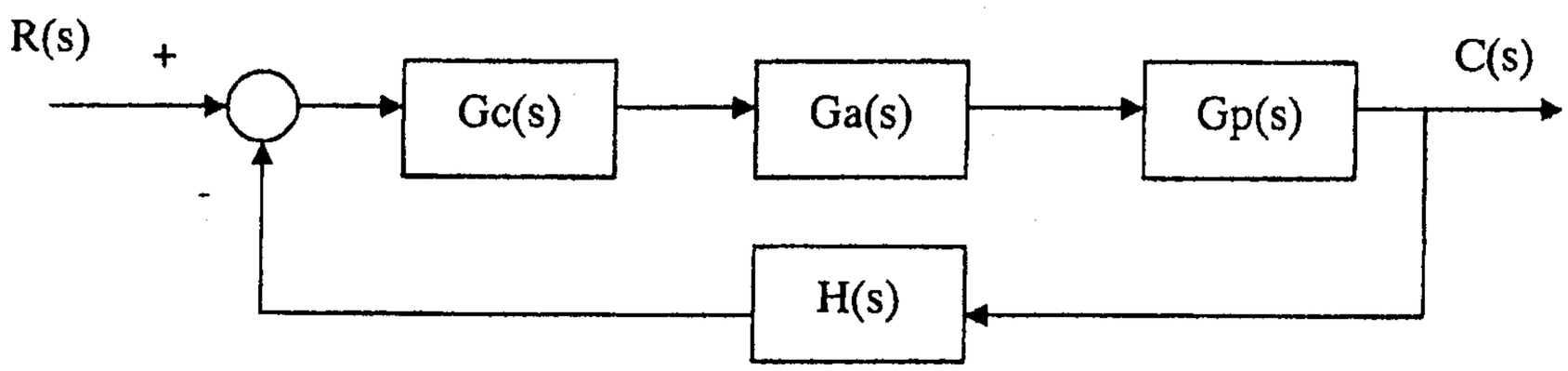
2. A control system is shown as the following diagram, **(30%)**

$Gc(s)=\frac{s+2}{s+5}$, $Ga(s)=\frac{1}{s}$, $Gp(s)=\frac{9}{s+2}$, **H(s)=1 Dtermine**

10% **(1) the settling time T_s**

10% **(2) the peak time T_p**

10% **(3) the steady-state error of the step input** $e_{step}(\infty)$



（背面仍有題目，請繼續作答）

3. Consider a system as the following, determine **(20%)**

10% **(1)if it is controllable?**

10% **(2) if it is observable?**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}-1 & -4 & -2\\ 0 & 6 & -11\\ 1 & 7 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}2\\ 0\\ 1\end{bmatrix}u$$

$$y=[0 \quad 0 \quad 1]\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

4. The Bode Plot of the unit feedback system with open-loop transfer function KG(s) is shown as the followings (K=1) , determine **(30%)**

10% **(1) Gain-crossover Frequency ω_g**

10% **(2) if the gain margin G.M.=40dB, then K=?**

10% **(3) if the phase margin P.M.= 45°, then K=?**