1. Find the transfer function, \( \Theta(s)/T_i(s) \), for the system of Fig. 1. (20 %)

![Fig. 1](image)

2. Design the values of \( K_1 \) and \( K_2 \) in the system of Fig. 2 to meet the following specifications: steady-state error component due to a unit step disturbance is \(-0.00012\); steady-state error component due to a unit ramp input is \(0.003\). (20 %)

![Fig. 2](image)

3. A position control system for a robot is shown in Fig. 3. Use a PID controller to design a system whose characteristic equation has a real root at \(-10\), a damping ratio \( \zeta = 0.8 \), and a natural frequency \( \omega_n = 2 \). (20 %)

![Fig. 3](image)
4. For the system shown in Fig. 4, the frequency-response curves for $G_1(j\omega)$ and $G_2(j\omega)$ were determined experimentally. Construct the log-magnitude plot for $G(j\omega) = G_1(j\omega)G_2(j\omega)$. Determine the equation for $G(j\omega)$, and evaluate the gain $K$.  

![Fig. 4](image_url)

5. Draw the Nyquist diagram for the system with $G(s) = \frac{K}{(s^3 + 2s^2 + 2)(s + 2)}$. Calculate the gain margin in dB and indicate the phase margin for $K = 6$.  

![Nyquist Diagram](image_url)