ECE317
HW #9

Problem 1:
Determine the type of the following unity-feedback systems for which the forward-path transfer functions are given:

(a) $G(s) = \dfrac{K}{(1+s)(1+10s)(1+20s)}$ **(b)** $G(s) = \dfrac{10e^{-0.2s}}{(1+s)(1+10s)(1+20s)}$

(c) $G(s) = \dfrac{10(s+1)}{s(s+5)(s+6)}$ **(d)** $G(s) = \dfrac{100(s-1)}{s^2(s+5)(s+6)^2}$

(e) $G(s) = \dfrac{10(s+1)}{s^3(s^2+5s+5)}$ **(f)** $G(s) = \dfrac{100}{s^3(s+2)^2}$

(g) $G(s) = \dfrac{5(s+2)}{s^2(s+4)}$ **(h)** $G(s) = \dfrac{8(s+1)}{(s^2+2s+3)(s+1)}$

Problem 2:
Determine the step, ramp and parabolic error constants of the following unity-feedback control systems. The forward-path transfer functions are given by:

(a) $G(s) = \dfrac{1000}{(1+0.1s)(1+10s)}$ **(b)** $G(s) = \dfrac{100}{s(s^2+10s+100)}$

(c) $G(s) = \dfrac{K}{s(1+0.1s)(1+0.5s)}$ **(d)** $G(s) = \dfrac{100}{s^2(s^2+10s+100)}$

(e) $G(s) = \dfrac{1000}{s(s+10)(s+100)}$ **(f)** $G(s) = \dfrac{K(1+2s)(1+4s)}{s^2(s^2+s+1)}$

Problem 3:
For the unity-feedback control systems described in Problem 2, determine the steady-state error for a unit-step, $u_s(t)$, unit-ramp, $tu_s(t)$, and parabolic input $\left(\frac{t^2}{2}\right) u_s(t)$. Check the stability of the system before applying the final-value theorem.

Problem 4:
The following transfer functions are given for a single-loop non-unity-feedback control system. Determine the steady errors for a unit-step, $u_s(t)$, unit-ramp, $tu_s(t)$, and parabolic input, $\left(\frac{t^2}{2}\right) u_s(t)$.

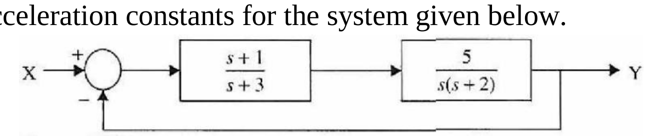
(a) $G(s) = \dfrac{1}{(s^2+s+2)}$ $H(s) = \dfrac{1}{(s+1)}$

(b) $G(s) = \dfrac{1}{s(s+5)}$ $H(s) = 5$

(c) $G(s) = \dfrac{1}{s^2(s+10)}$ $H(s) = \dfrac{s+1}{s+5}$

(d) $G(s) = \dfrac{1}{s^2(s+12)}$ $H(s) = 5(s+2)$

Problem 5:
Find the position, velocity and acceleration constants for the system given below.



Problem 6:
For the system of Problem 5, find the steady-state error for (a) a unit-step, $u_s(t)$, (b) a unit-ramp, $tu_s(t)$, and (c) a unit parabolic input, $\left(\frac{t^2}{2}\right) u_s(t)$.