Subject: HW1 Solution
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1) a) $u(t) \rightarrow \frac{1}{s}$

b) $tu(t) \rightarrow 1/s^2$

c) $\sin(\omega t)\, u(t) \rightarrow \frac{\omega}{s^2+\omega^2}$

d) $\cos(\omega t)\, u(t) \rightarrow \frac{s}{s^2+\omega^2}$

e) $e^{-\alpha t}\sin(\omega t)\, u(t) \rightarrow \omega/(s+\alpha)^2+\omega^2$

f) $e^{-\alpha t}\cos(\omega t)\, u(t) \rightarrow (s+\alpha)/(s+\alpha)^2+\omega^2$

g) $3t^2 e^{-t} u(t) \rightarrow 6/(1s+1)^3$

h) $\cos(t)\sin(t)\, u(t) \rightarrow 1/s^2+4$

i) $(t-3)\, e^{t-3}\, u(t-3) \rightarrow e^{-3s}/(s-1)^2$

j) $(te^{-\alpha t} 2t\cos(t))\, u(t) \rightarrow \dfrac{2(2(s+\alpha)^2 - 6(s+\alpha))}{((s+\alpha)^2+1)^3}$

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2) $F_1(s) \Rightarrow (1/2\, e^{-(t-1)} - 3e^{-2(t-1)} + 7/2\, e^{-3(t-1)})\, u(t-1)$

$F_2(s) \Rightarrow (-1/2\, te^{-2t} - 1/4\, e^{-2t} + 1/4)\, u(t)$

$F_3(s) \Rightarrow \frac{d^2}{dt^2} h(t) - 3\, d/dt\, h(t) + h(t) + 2\int_{-\infty}^{t} h(t)\, dt$

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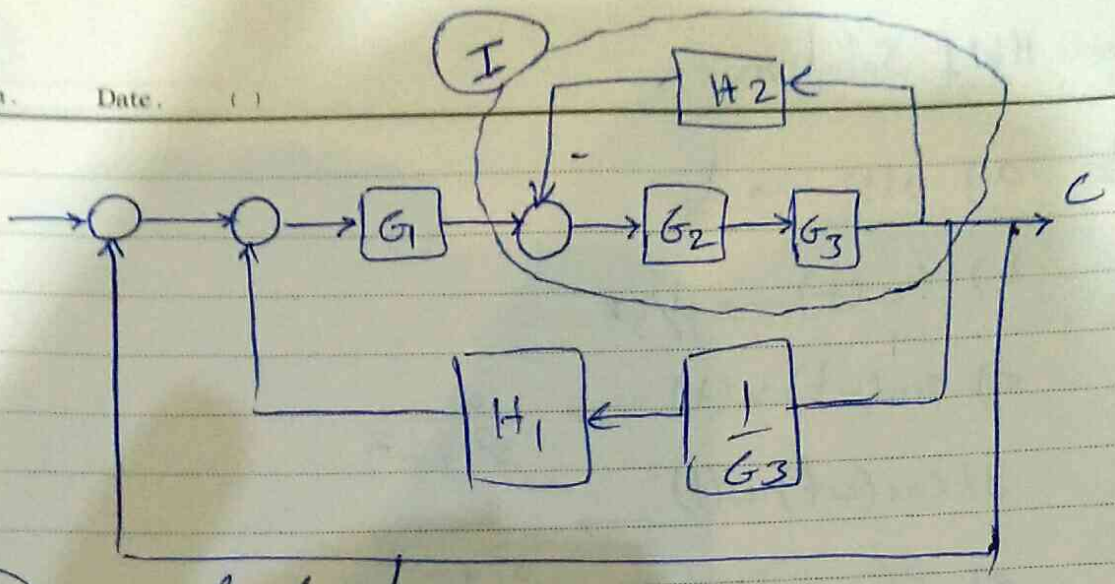
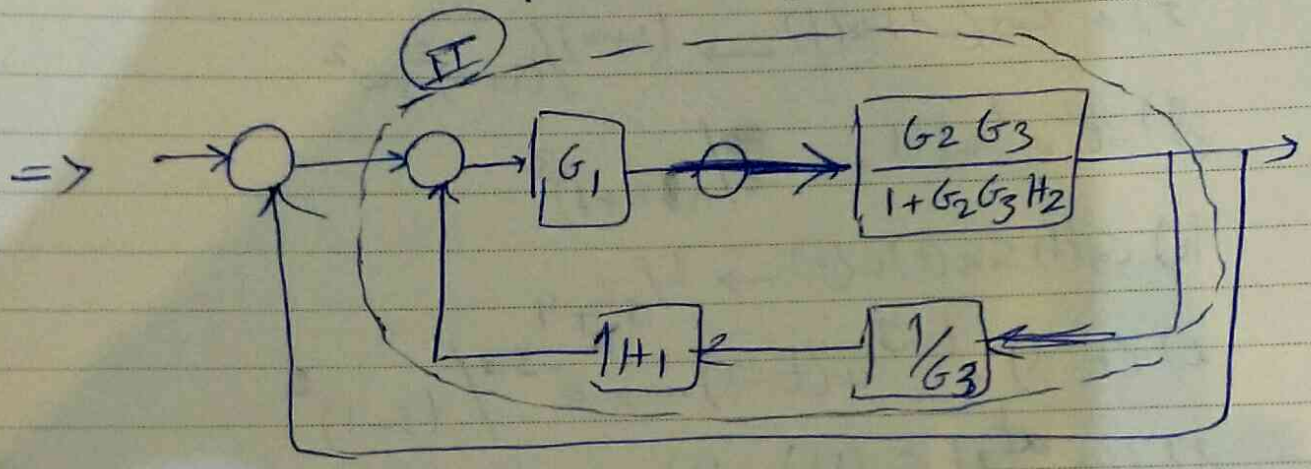


I $\Rightarrow A = \dfrac{G_2 G_3}{1 + G_2 G_3 H_2}$



II $\Rightarrow B = \dfrac{G_1 G_2 G_3 / 1 + G_2 G_3 H_2}{1 + \dfrac{G_1 G_2 G_3}{1 + G_2 G_3 H_2} \times \dfrac{1}{G_3} \times H_1}$

$\Rightarrow$ Answer $= \dfrac{B}{1 + B}$

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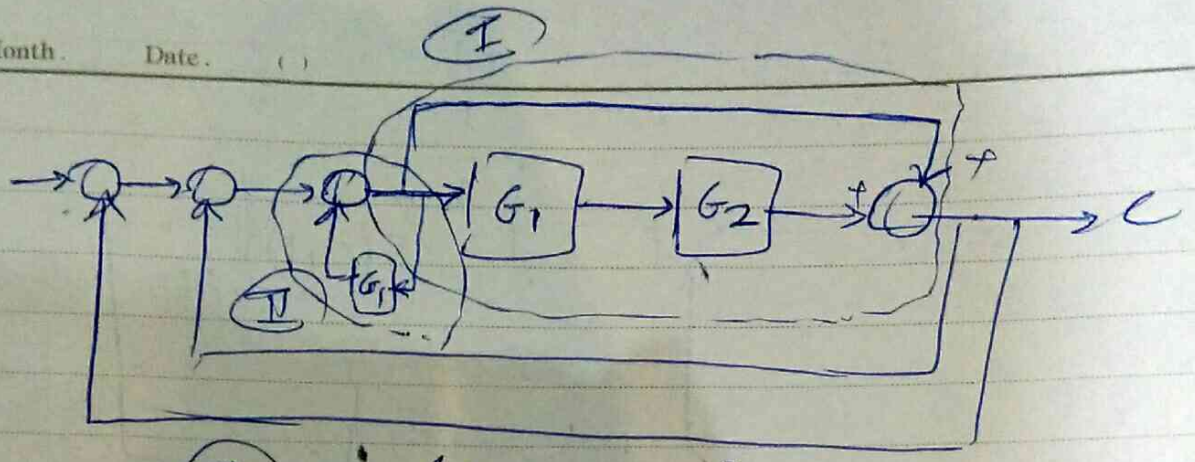
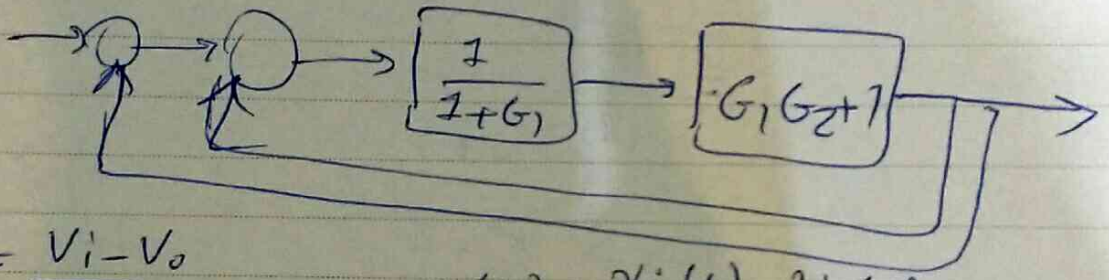
3 b)



I => $(G_1G_2 + 1)$

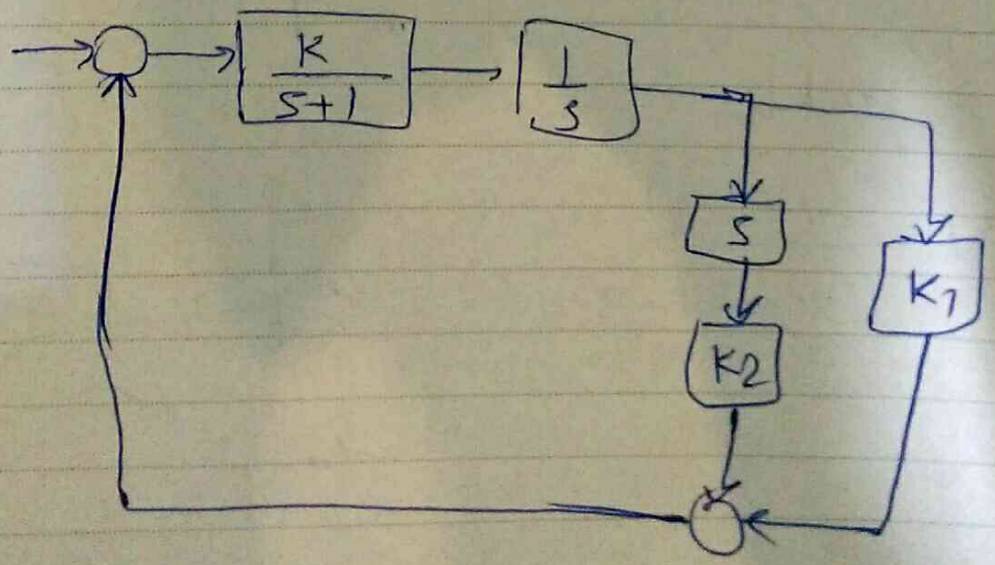
II => $1/1 + G_1$



4 $i = \frac{V_i - V_o}{R}$ => $I(s) = \frac{V_i(s) - V_o(s)}{R}$

$V_o = 1/C \int i dt$ => $V_o(s) = \frac{I(s)}{Cs}$ => $I(s) = V_o(s)Cs$

=> $V_o(s)Cs = \frac{V_i(s) - V_o(s)}{R}$ => $V_o(s)/V_i(s) = \frac{1}{1+RCs}$



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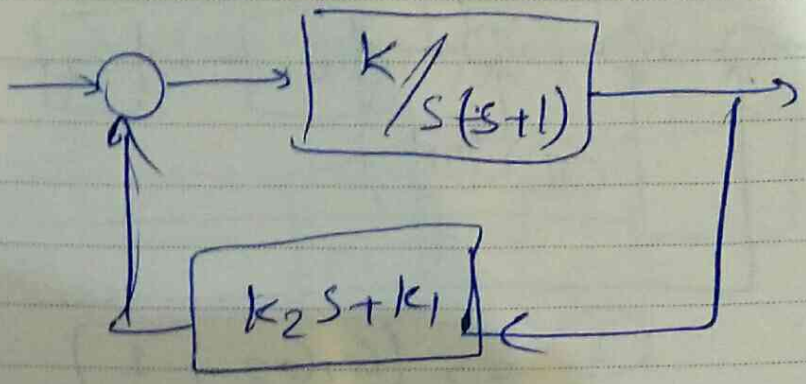

$$C/R = \frac{K}{s^2+(kk_2+1)\cdot s+kk_1}$$

$$= \frac{6}{s^2+5s+6}$$

$$\Rightarrow k = 6$$

$$k_2 = 2/3$$

$$k_1 = 1$$

6) $$F(s) = \frac{2(s+3)}{s^2+2s+5}$$

=> Stable

$$F(s) = \frac{2(s-3)}{s^2-2s-3}$$

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