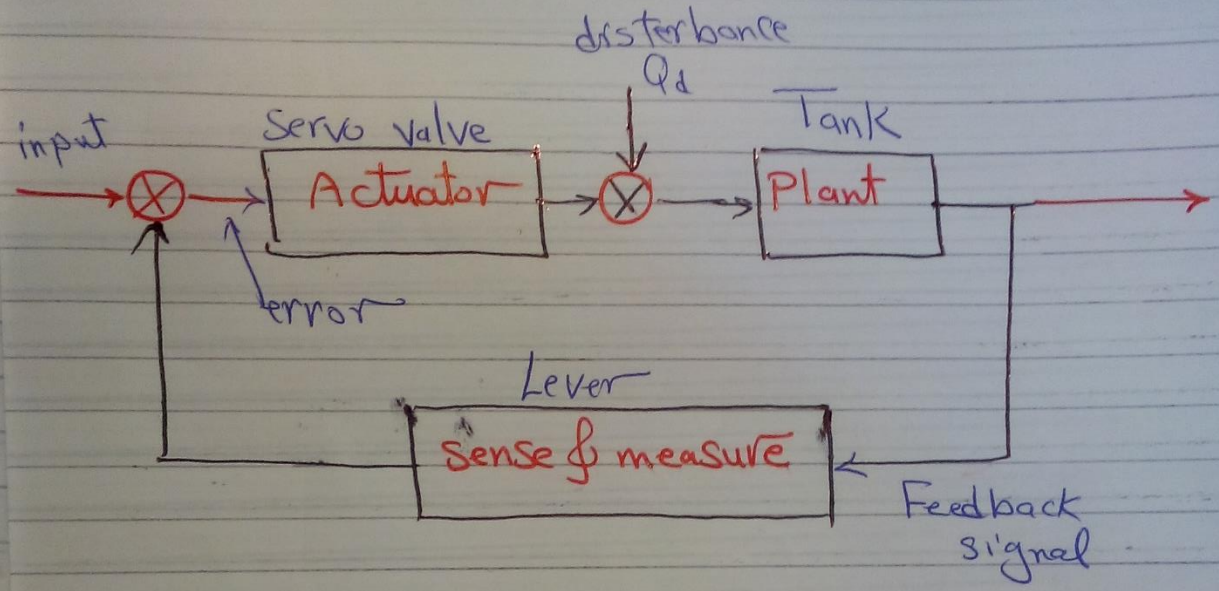
MID-TERM Solution

solution of Mid-Term (1/3)

(a) sketch ablock diagram for The model.



→ The liquid-level control system

→ The required output is filling The tank to reach a certain head H(s).

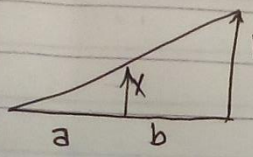
→ To measure The head of water in The tank There is a floating system which indicates The level.

→ using a servo valve to compare between The feed back signal and input signal. by using Mechanical lever.

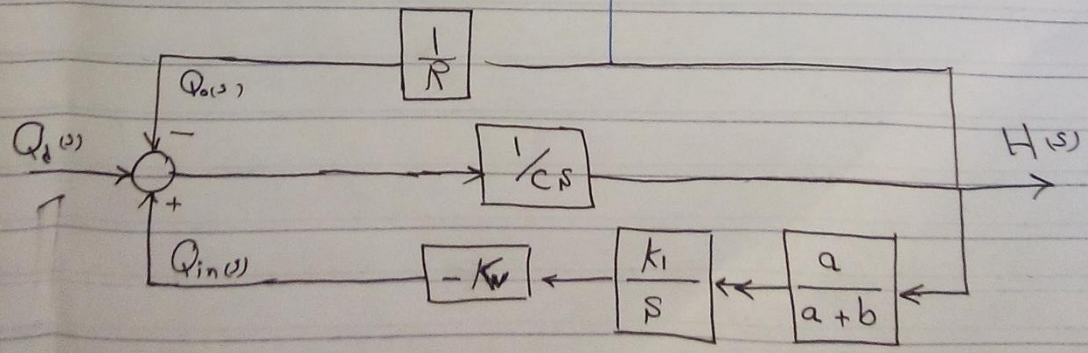
MID-TERM Solution

Solution of mid-Term (2/3)

(b) write the governing equation of physical model, also frequency equ.

equations in time domain	equations in S-domain
$q_i + q_d - q_o = C\frac{dh}{dt}$ ①	$Q_{in(s)} + Q_{d(s)} = Q_{o(s)} = [C.s]H_{(s)}$
 $x = \frac{a}{a+b}h(t)$ ②	$X_{(s)} = \left(\frac{a}{a+b}\right).H_{(s)}$
$\frac{dy}{dt} = K_1 x$ ③	$s.Y_{(s)} = [K_1]X_{(s)}$
$q_o = \frac{h(t)}{R}$ ④	$Q_{o(s)} = \left[\frac{1}{R}\right].H_{(s)}$
$q_i = -K_v.y$ ⑤	$Q_{i(s)} = [-K_v]Y_{(s)}$

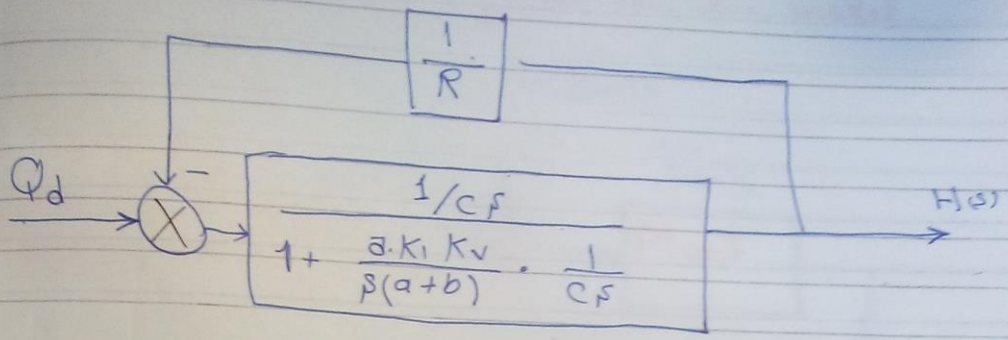
(c) Draw Block diagram of physical Model.

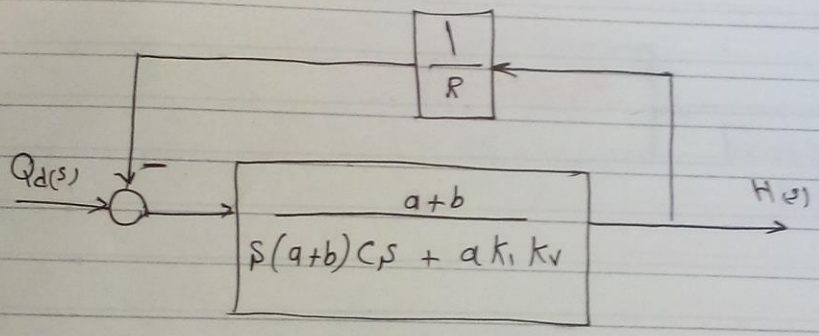


MID-TERM Solution

Solution of mid-Term (3/3)

* block diagram reduction.





(d) Determine an appropriate transfer function.

$$T.F = \frac{\frac{s(a+b)}{(a+b)Cs + aK_1K_v}}{1 + \left(\frac{(a+b)s}{(a+b)Cs + aK_1K_v}\right)\left(\frac{1}{R}\right)} =$$

$$T.F = \frac{s(a+b)R}{[s(a+b)Cs + aK_1K_v]R + (a+b)s}$$

by substituting by given values ←

$$T.F = \frac{0.5s}{s^2 + s + 0.5}$$