1. Question (1) — Marks (15)

Consider the liquid-level control system shown in figure. We assume that the velocity of the power piston (valve) is proportional to pilot valve displacement x, or $\frac{dy}{dt} = K_1 x$

Where K_1 is a positive constant. We also assume that the change in the inflow rate qi is negatively proportional to the change in the valve opening y, or $q_i = -K_v y$

Where KV is a positive constant.

Assuming the following numerical values for the system

$C = 2\ \text{m}^2, \quad R = 0.5\ \text{sec/m}^2, \quad K_v = 1\ \text{m}^2/\text{sec}$

$a = 0.25\ \text{m}, \quad b = 0.75\ \text{m}, \quad K_1 = 4\ \text{sec}^{-1}$

a) Sketch a block diagram for model, also describe a closed-loop feedback control system.
b) Write governing equation of physical model, also frequency equations.
c) Draw block diagram for model of the physical system and select many of its parameters.
d) Determine an appropriate transfer function for the system. $H(s)/Q_d(s)$

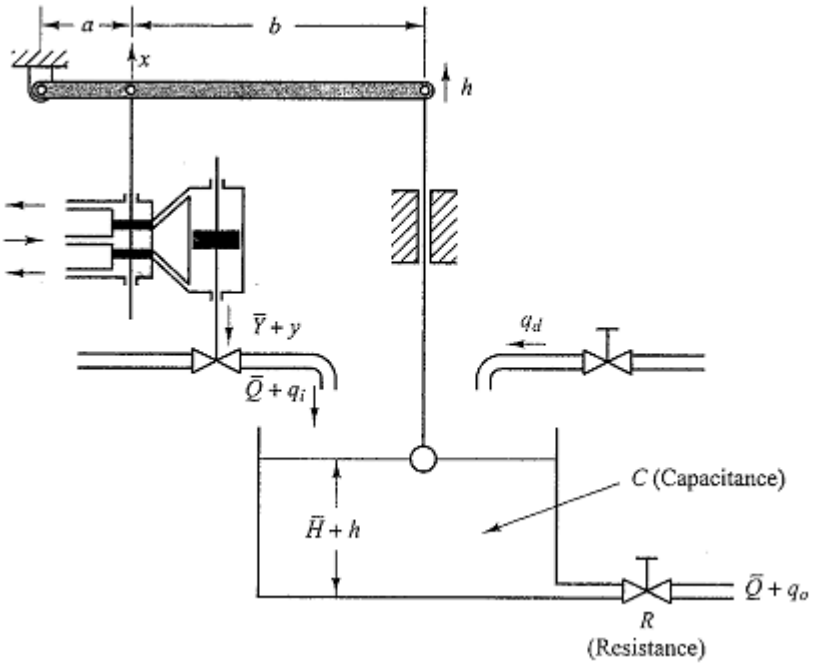

Fig. 1. Liquid-level control system