Assignment 12

The task is to establish the assignment has passed.

All the instructions have been followed.

Consider a simple hydraulic system in the figure below.

\[ \frac{\text{d}h}{\text{d}t} = \frac{Q_{\text{in}} - Q_{\text{out}}}{A_{\text{tank}}} \]

Where:
- \( h \) is the height of the fluid in the tank
- \( A_{\text{tank}} \) is the cross-sectional area of the tank
- \( Q_{\text{in}} \) is the inflow rate
- \( Q_{\text{out}} \) is the outflow rate

A. Consider the inflow rate as constant, \( Q_{\text{in}} = 5 \text{ m}^3/\text{min} \), and the outflow rate as a function of the height, \( Q_{\text{out}} = k_h h^2 \), where \( k_h \) is a constant. Determine the height of the fluid in the tank as a function of time.

B. Consider the outflow rate as constant, \( Q_{\text{out}} = 3 \text{ m}^3/\text{min} \), and the inflow rate as a function of the height, \( Q_{\text{in}} = k_q h \), where \( k_q \) is a constant. Determine the height of the fluid in the tank as a function of time.

C. Consider both inflow and outflow rates to be functions of the height. Determine the height of the fluid in the tank as a function of time.

D. Consider the inflow rate and outflow rate both to be functions of the height. Determine the height of the fluid in the tank as a function of time.

E. Consider the inflow rate and outflow rate to be sinusoidal functions of the height. Determine the height of the fluid in the tank as a function of time.

F. Consider the inflow rate and outflow rate to be exponentially increasing functions of the height. Determine the height of the fluid in the tank as a function of time.