DATA SHEET

Course: CL 433

Date: 30/9/2022

Expt. Number & Name: CT 404

B6a

Actuators

Inherent

x Volt (V)	ΔP (mmHg)	Q (LPH)
5	24	296
4.8	24	269
4.6	24	225
4.4	24	193
4.2	24	156
4.0	24	137
3.8	24	119
3.6	24	100
3.4	24	85
3.2	24	75
3.0	24	59.5
3.2	24	74
3.4	24	87
3.6	24	98
3.8	24	114
4.0	24	130
4.2	24	152
4.4	24	185
4.6	24	218
4.8	24	252
5	24	295

Installed

x Volt (V)	ΔP1 (mmHg)	Q1 (LPH)
5	300	23
4.8	280	30
4.6	270	35
4.4	252	42
4.2	236	48
4.0	217	55
3.8	195	63
3.6	176	70
3.4	158	76
3.2	137	82
3.0	121	88
3.2	136	83
3.4	155	75
3.6	175	69
3.8	198	63
4.0	214	59
4.2	236	50
4.4	257	41
4.6	269	36
4.8	283	29
5.0	296	24

Student Sign. 1) .... 2) .... 3) .... 4) .... 5) .... 6) ....

TAs Sign. 1) Namith 30/9/22 .... 2) Zaki 30/9/22 .... 3) ....

प्र.क्र.
Q. No.

Q. No.

Q. No.

Sample calculation :→

for Inherent characteristics 5V to 3V

Showing calculation for $V = 4V$

$$\Delta P = 24 \, mmHg = 3199.73$$
$$\simeq 3200 \, N/m^2$$

$$\text{flow rate} = 137 \, lit/hr$$
$$= 3.805 \times 10^{-5} \, m^3/sec$$

Here, $\rho = 1000 \, kg/m^3$ of water

we know that,

$$y = Q\sqrt{\rho/\Delta P}$$

$$y = 3.805 \times 10^{-5} \times \sqrt{\frac{1000}{7332.71}}$$

$$y = 2.127 \times 10^{-5}$$

Q. No.

Q. No.

The predicted expression for volumetric flow rate is derived.

$$y = a\sqrt{\frac{\rho}{\Delta P}} = a b^{x-1}$$ (Equal percentage value)

~~logy = xl~~

$$\ln y = x \ln b + (\ln a - \ln b)$$

By regression method on data points we will get slope = 4

so $\ln b = 4 \Rightarrow b = 54.6$

Also $\ln a = -9.961$
$\Rightarrow a = 4.720$

Error Calculations →

$$E = \left|\frac{y_{actual} - y_{predicted}}{y_{actual}}\right| \times 100$$

→ for V = 4V

$y_{actual} = 2.137 \times 10^{-5}$

$y_{predicted} = 2.135 \times 10^{-5}$

Conclusion

$$E = \frac{(2.135 - 2.127)}{2.135} \times 100$$

$$E = 1.138\ \%$$

Error is very low for equal percentage valve mo[del]

Q. No.						Q. No.					

for Installed Characteristics. from 3V to 5V

let's do for $V = 4V$

$$\Delta P = 55 \text{ mm Hg}$$

$$Q_{actual} = 217 \text{ LPH}$$

$$\rho = 1000 \text{ kg/m}^3 \qquad n =$$

$$y = Q\sqrt{\frac{\rho}{\Delta P}} \qquad Q_{predicted} = Y\sqrt{\frac{\Delta P}{\rho}}$$

$$= a\, b^{n-1} \sqrt{\frac{\Delta P}{\rho}}$$

By regration of data points we get

$$a = \cancel{3.4885}, \; 4.706 \qquad , \; b = 46.632$$

Now, $Q_{predicted} = 2.08 \times 10^{-5}$

$$\varepsilon = \left| \frac{Q_{actual} - Q_{predicted}}{Q_{actual}} \right| \times 100 = 6.18\%$$

प्र.क्र.
Q. No.

Hence calculating the average values,

we get $a = 4.71 \times 10^{-5}$

$b = 51.7$

for $y = a\, b^{x-1}$

The error shown in the above model was observed to be quite less.

Another model $y = a x^b$ was tried

and the linear regression of $\ln y = \ln a + b \ln x$ was performed yielding $R^2 = 0.9962$ and avg error of 15.5126 which was less accurate than the previous model.