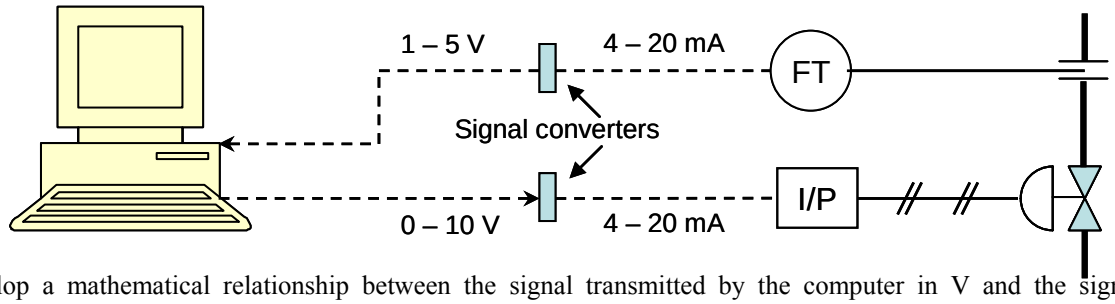
Question 2

A computer is used as a SCADA system to control a pilot plant. It receives signals of between 1 to 5 V from various transmitters via signal converters and transmits signals of between 0 to 10 V to control valves via signal converters.

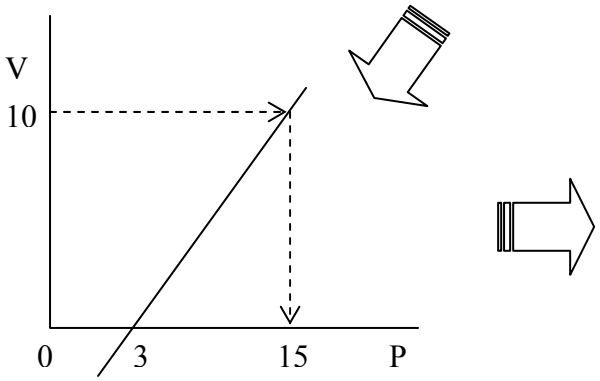


Develop a mathematical relationship between the signal transmitted by the computer in V and the signal received by a control valve in psig.

If the flow transmitter had been calibrated for flow of 0 to 8 m^3/hr, calculate the signal received by the computer, in volt, when 5.5 m^3/hr of liquid flows through the pipe.

Answer

Voltage output (V)	Pressure (P)
0	3
10	15



General linear equation: y = mx + c

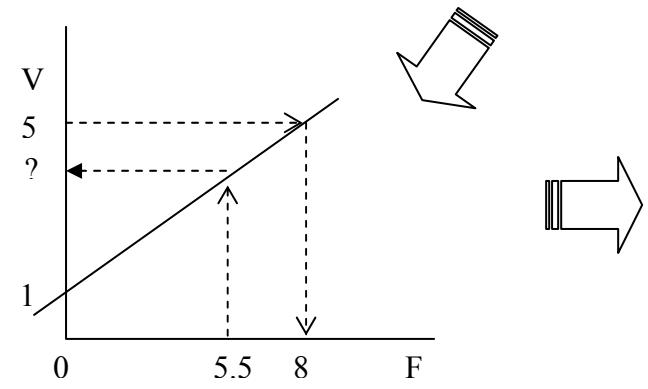
$$m = \frac{10-0}{15-3} = \frac{5}{6}$$

$$c = y - mx = 0 - \frac{5}{6}(3) = -2.5$$

Therefore,

V = 5/6 P – 2.5

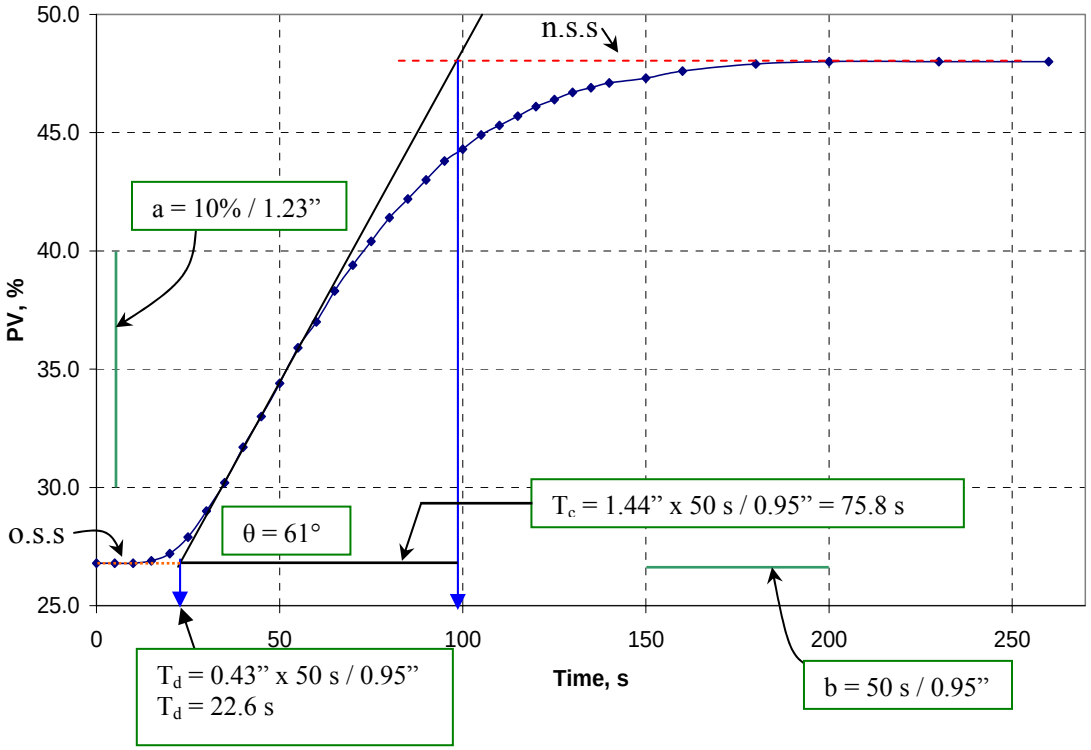
Flow (F)	Voltage input (V)
0	1
5.5	V
8	5



$$\frac{5-1}{8-0} = \frac{V-1}{5.5-0}$$

$$V = 3.75$$

Question 1



1. Optimum PID based on Zieglar-Nichols

$$RR = \frac{\tan 61}{55\%}\frac{10\%/1.23''}{50\,s/0.95''} = 0.00507/s$$

PB = 83.3 (0.00507) (22.6) = 9.5%

I = 2 (22.6) = 45 s

D = 0.5 (22.6) = 11 s

2. Optimum PID based on Cohen-Coon

$$\mu = \frac{T_d}{T_c} = 0.3$$

$$PB = \frac{100}{1.35(1+0.3/3)}0.00507(22.6) = 8.0\%$$

$$I = 2.5(22.6)\frac{1+0.3/5}{1+3(0.3)/5} = 51s$$

$$D = \frac{0.37(22.6)}{1+0.3/5} = 8s$$