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SECTION-B

- Q2. List the different types of pneumatic actuators compare and contrast them and explain the pneumatic actuator with larger thrust force.
- Q3. Explain the mathematical modeling of thermal system.
- Q4. Compare and contrast of Proportional, Integral and derivative controller.
- Q5. Explain the proportional integral derivative (PID) control action with dead time.
- Q6. A 1.5 inch control valve has following specifications :

At 40 % valve opening $C_v = 1.5$

At 30 % valve opening $C_v = 0.9$

At 80 % valve opening $C_v = 9.25$

Calculate C_v at 90% valve opening where the control valve has equal percentage characteristics.

SECTION-C

- Q7. Consider the error voltage E_p is given by following relation.

$$E_p = t \% \quad (0-1 \text{ sec})$$

$$E_p = I \% \quad (1-3 \text{ sec})$$

$$E_p = (-1/2 t + 2.5) \% \quad (3-5 \text{ Sec})$$

Find and draw the controller output with $K_p = 5$, $K_i = 0.5 \text{ S}^{-1}$, $K_d = 0.5 \text{ s}$ and $P(0) = 50\%$.

- Q8. a) Explain the functioning of pneumatic proportional integral (PID) controller with suitable diagram.
- b) Describe the construction and working of E-P Convert.
- Q9. Write short notes on following :
- a) Tuning of controllers
- b) Hydraulic actuator