

(3 Hours)

Total Marks-80

- N.B.** (1) Question No. 1 is compulsory.
 (2) Attempt any **Three** questions out of remaining **five** questions.
 (3) Assume any suitable data if necessary.
 (4) Figure to the right indicate full marks.



1. Attempt the following questions: 20
- Why pneumatic instrumentation is preferred and used in plants?
 - Incorporation of P-I action may lead to instability in the closed loop performance-justify
 - Compare and contrast feedback and feedforward control schemes used in process industry.
 - What is the need of controller tuning? How does PID settings affect controller dynamics?

2. a) Consider a process with the following input and output relationship. Compute relative Gains. 10

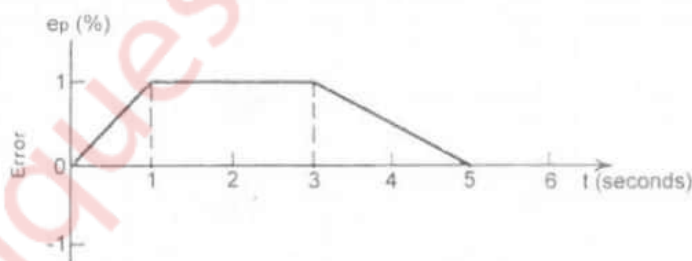
$$\bar{y}_1 = \frac{1}{s+1} \bar{m}_1 + \frac{1}{0.1s+1} \bar{m}_2$$

$$\bar{y}_2 = \frac{-0.2}{0.5s+1} \bar{m}_1 + \frac{0.8}{s+1} \bar{m}_2$$

- b) Develop mathematical model for two tank interacting capacities. 10
3. a) For a proportional controller, the controlled variable is a process temperature with a range of 50 to 130° C and a setpoint of 73.5° C. Under nominal conditions, the setpoint is maintained with an output of 50%. Find the proportional offset resulting from a load change that requires a 55% output if the proportional gain is (a) 0.1 (b) 0.7 (c) 2.0 and (d) 5.0. 10

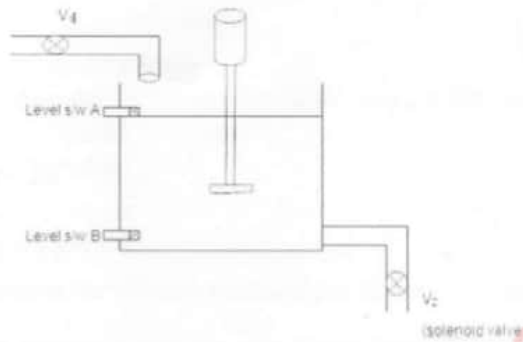
- b) Explain inverse response behavior of the process with example and also explain inverse response compensator. 10

4. a) A PID controller has $k_p = 5.0$, $k_I = 0.7 \text{ s}^{-1}$, and $k_D = 0.5 \text{ s}$ and $P_I(0) = 20\%$. Plot the controller output for the error input shown in figure. 10



- b) Explain the procedure for tuning PID controller using Ziegler Nicholas method. In an application while tuning by Z-N method process begins oscillations with 30% proportional band in 11.5 minutes. Find nominal PID control settings. 10

5. a) Develop electronic PID controller and explain each part in detail. 10
 b) With suitable example explain split range and ratio control schemes. 10
6. a) For what type of processes cascade control is preferred? Explain cascade control scheme for CSTR. 10
 b) Write a Physical ladder Program for a tank which is sequenced to mix the liquid fertilizer according to following sequence:- 10



- 1) Start PB is pressed to start operation & V1 is open to fill the tank upto level A.
 - 2) As the tank fills, a level s/w A close NO contact to energize stirrer motor to start automatically & operate it for 15 sec to mix the fluid.
 - 3) When stirrer stops, V2 opens to empty tank.
 - 4) When the tank is completely empty s/w B opens and de-energizes the solenoid valve V2.
 - 5) A stop button is pressed to stop operation.
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