Chem VIII - 1354 : Ad. Process Control 24|5|

QP Code :719400

(3 Hours) **[Total Marks :80**

N.B.: (1) Question No.1 is compulsory.
(2) Attempt any three questions from the remaining five questions.
(3) Assume suitable data wherever necessary.
(4) Figures to the right indicates full marks

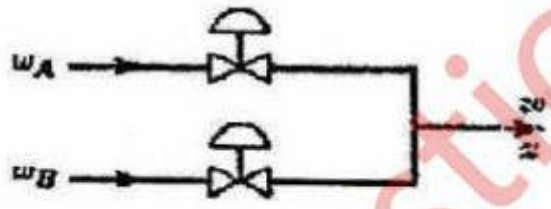
1. (a) Describe Cascade control with its block diagram **5**
(b) Write a short note on Smith Predictor **5**
(c) Write a short note on sampling **5**
(d) Write short note on relative gain array **5**

2. a. The following product quality data y_m were obtained from a bioreactor, based on a photometric measurement evaluation of the product **10**

Time (min)	0	1	2	3	4	5	6	7	8
y_m	0	1.5	0.3	1.6	0.4	1.7	1.5	2.0	1.5

Filter the data using an exponential filter with $\Delta t = 1$ min and $\alpha = 0.5$

b. An in-line blending system is shown below. **10**



It is proposed that w and x be controlled using a conventional multiloop control scheme, with W_A and W_B as the manipulated variables. Derive an expression for RGA and recommend the best controller pairing for the following conditions $w = 4$ kg/min and $x = 0.4$

3. a. Consider a first order plus time delay model. **10**

$$\frac{Y(s)}{U(s)} = \frac{Ke^{-\theta s}}{\tau s + 1}$$

i. Derive an equivalent step response model by consider the the analytical solution to a unit step change in the input.

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ii. Calculate the step response coefficients for the parameter values of $K = 5, \tau = 15$ and $\theta = 3$ min

b. Discuss batch control systems.

4. a. Discuss hypothetical plant for plant-wide control studies.
   b. Discuss the procedure for the design of plant wide control systems.

5. a. Derive transfer function for analog exponential filter.
   b. Derive discrete transfer function for PID controller.

6. Write short notes on the following
   a) Optimal control
   b) Minimum Variance Control
   c) Inferential Control
   d) Issues in Plant wide control