Q. P. Code: 39332

Duration:-03 Hrs **Total marks assigned to the paper: - 80**

Instructions to the candidates if any:-

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

Q. No. 1

a. Write a short note on Adaptive control systems. [05]

b. Write a short note on Smith Predictor [05]

c. Write a short note on batch process optimization [05]

d. Derive discrete transfer function for PI controller [05]

Q. No. 2

a. Derive equation for moving average filter [10]

b. A process has the following transfer function [10]

$$G(s) = \begin{bmatrix} \frac{-2e^{-s}}{10s+1} & \frac{1.5e^{-s}}{s+1} \\ \frac{1.5e^{-s}}{s+1} & \frac{-2e^{-s}}{10s+1} \end{bmatrix}$$

Use the RGA approach to determine the recommended controller pairing based on steady state considerations

Q. No 3

a. For the difference equation

$$y(k) = 0.9744y(k-1) - 0.2231y(k-2) - 0.3225y(k-2) + 0.5712y(k-3)$$

Derive its discrete transfer function [10]

b. Discuss batch control systems [10]

Q. P. Code: 39332

Q. No. 4

a. Discuss hypothetical plant for plant-wide control studies [10]

b. Discuss the procedure for the design of plant wide control systems [10]

Q. No 5

a. A signal is given by $y_m(t) = t + 0.5sint(t^2)$ is to be filtered with an exponential digital filter over the interval $0 \leq t \leq 20$. Using two different values of α (0.8 and 0.2) determine the output of the filter for a sampling period of 1 min. Plot the response for both the cases [10]

b. A 2×2 process has the following steady state gain matrix

$$K = \begin{bmatrix} 1 & 0 \\ 10 & 1 \end{bmatrix}$$

Calculate the Eigen values, singular values and the condition number [10]

Q. No 6 [20]

Write short notes on the following

a. Types of filters

b. Minimum Variance Control

c. Cascade control

d. Issues in Plant wide control

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