

**B.E. Instrumentation Engineering (Model Curriculum) Semester-VII**  
**IN702M - Process Control**

P. Pages : 2



Time : Three Hours

**GUG/S/25/14257**

Max. Marks : 80

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- Notes : 1. All questions carry marks as indicated.  
2. Due credit will be given to neatness and adequate dimensions.  
3. Assume suitable data wherever necessary.

1. a) Write a note on Adaptive control mechanism. 8

Also Explain:

- i) Gain scheduling
- ii) Model Reference Adaptive modelling.
- iii) Self-Tunning Regulation

- b) Explain cascade control strategy with block diagram and proper example. 8

**OR**

2. a) Compare between regulatory and servo control mechanism. 8

- b) Write a note on design aspects of process control system. 8

3. a) Write a note on: 8

- a) White box model
- b) Black box model
- c) Grey box model

- b) Derive mathematical model for three CSTR in series with variable hold up. 8

**OR**

4. a) Derive the mathematical model for CSTR for 8

- i) Total mass balance
- ii) Total energy balance
- iii) Momentum

- b) Compare between white box model and black box model. 8

5. a) Derive the transfer function of a second-order system and explain the dynamic response of overdamped and critically damped systems. 8

- b) Write a note on non-interacting capacities and also derive mathematical model for two interacting capacities in series. 8

**OR**

6. a) Explain Dynamic response of 1<sup>st</sup> order lag system also explain its features. 8

- b) Explain 1<sup>st</sup> order system for  
Natural response  
Forced response 8

7. a) Discuss “Interaction of control loops for stirred tank reactor”. 8

b) Explain interaction of control loops for two control loops for two controlled outputs and two manipulated variables. 8

OR

8. a) Consider a process following input-output relationships: 8

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

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

Select the loops using Relative Gain Array (RGA)

- b) Explain “Bristol’s relative gain array (RGA) Method” for selection of pairs of input and output variables to minimize interaction of loops. 8

- 9.** a) Discuss the design of PI controller using fuzzy logic in process control application. **8**

b) Define fuzzy logic. Discuss the potential advantages of fuzzy logic-based system over classical approach. **8**

OR

- 10.** a) Discuss stepwise design procedure of neural network-based controller give its applications. **8**

b) Discuss the design of PI controller using fuzzy logic in process control application. **8**

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