

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-Tuning 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:  
a) White box model  
b) Black box model  
c) Grey box model 8
- 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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