



- 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) Describe process control mechanism in detail with neat and labelled diagram. **8**  
b) Compare between regulatory and servo control mechanism. **8**

**OR**

2. a) Explain cascade control strategy with block diagram and proper example. **8**  
b) Write a note on Adaptive control mechanism. **8**  
Gain scheduling  
Model reference adaptive modelling  
Self-tuning regulation
3. a) Explain various methods of mathematical modelling with suitable examples. **8**  
b) Derive mathematical model for plane CSTR used for level control for **8**  
Total mass balance in tank  
Total energy balance  
Momentum.

**OR**

4. a) Derive mathematical model for CSTR for exothermic reaction having cooling jacket in **8**  
which conversion of product  $A \rightarrow B$  for exothermic reaction w.r.to  
Total mass balance in tank  
Balance of component of A  
Total energy balance  
b) Derive mathematical model for three CSTR in series with variable hold up. **8**
5. a) Obtain mathematical model of U-tube manometer. **8**  
b) Write a note on non-interacting capacities also derive mathematical model for two **8**  
interacting capacities in series.

**OR**

6. a) Discuss 1<sup>st</sup> order system with respect to its capacity for **8**  
Mass storage  
Energy storage

- b) Write a note on non-interacting capacities and derive mathematical model for two interacting capacities in series. **8**
7. a) Explain interaction of control loops for two control loops for two controlled outputs and two manipulated variables. **10**
- b) Explain “interaction of control loops for stirred tank reactor.” **6**

**OR**

8. a) Consider process with following input and output relationships. **10**

$$y_1 = \frac{1}{s+1} m_1 + \frac{1}{0.1s+1} m_2$$

$$y_2 = \frac{-0.2}{0.5s+1} m_1 + \frac{0.8}{s+1} m_2$$

Select loops using relative gain array (RGA).

- b) Explain Morari Resiliency Index (MRI) in detail. **6**
9. a) Give comparison between PID, Fuzzy logic and neural network controller w.r.to following points **8**
- Requirement of process knowledge
  - Tuning parameters
  - Application to linear and nonlinear systems
  - Self-learning and adaptive
  - Applications.
- b) Discuss stepwise design procedure of fuzzy logic-based controller give its applications. **8**

**OR**

10. a) How fuzzy sets are represented mathematically? Illustrate with example. **8**
- b) Discuss the role of artificial neural networks in process control application. Illustrate with suitable example. **8**

\*\*\*\*\*