B.Tech. Seventh Semester (Chemical Engineering) (C.B.S.)

Process Control and Instrumentation

Paper - II

P. Pages : 2 **TKN/KS/16/7837**

Time : Three Hours * 0 2 7 3 * Max. Marks :80

Notes :
1. All questions carry equal marks.
2. Answer **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and chemical equations should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. a) For a first order system, the value of input is varied in the sinusoidal manner with 'A' as the amplitude of variation and 'W' as radian frequency. Derive the response equation. **8**

b) A tank having cross sectional area of 0.5 m^2. The steady state flow rate of liquid is 0.7 m^3/min. The flow rate is subjected to impulse change of magnitude 0.05 m^3/min. The time constant for the tank is 1 min. Determine the outlet flow rate at t = 0.5 min, t = 1 min. t = 5 min. **8**

2. a) Derive the equation for offset when the first order control system is controlled by proportional derivative controller for regulator control. problem. Assume unity feedback. **7**

b) Derive the response equation for two first order systems connected in interacting way and step change is given to input variable. Plot the response. **9**

3. a) A step change of magnitude 6 is introduced into the control system having transfer function $G(S) = \frac{10}{5S^2 + 0.6S + 6}$. **10**

Calculate :
i) Overshoot, (ii) Decay ratio (iii) Radian frequency.

b) A second order system is observed to exhibit an underdamped response having the ultimate value of response as 16, the minimum value of response 10, If the value of damping parameter are 0.6, 0.4, 0.2 & 0.1 show that as the damping parameter decreases the overshoot increases for the system. **6**

4. a) Explain the working mechanism of pneumatic proportional - derivative controller with the help of neat labelled diagram. **8**

b) Discuss the dynamic behaviour of pneumatic control valve. Obtain the transfer function for control valve. **8**

5. a) Explain the direct digital feedback control of continuous stirred tank reactor with the help of neat labelled diagram. **8**

b) What is distributed control system ? Explain. **8**

6. a) Explain the principle, construction and working of liquid in metal thermometer with the help of neat labelled diagram. **8**

b) What do you understand by thermistors ? Explain. **8**

7. a) Explain the working of radiation level measurement instrument. **8**

b) Explain the working of Bell differential pressure gauge with the help of neat labelled diagram. **8**

8. Write short notes on **any four.** **16**

i) Linearization.

ii) Functions of different modes of control.

iii) Hysteresis of control valve.

iv) Supervisory control.

v) Classification of transducers.

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