B.Tech. Seventh Semester (Chemical Engineering) (CGS)

11659 : Process Dynamics and Control : 7 CH 03

P. Pages : 2 **AW – 3378**

Time : Three Hours * 0 2 5 5 * Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Diagrams and chemical equations should be given wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Discuss the characteristics of first order system for step forcing function in the input variable of the system. **7**

b) What do you mean by non-interacting multi capacity control system? Draw the response for a step input for same. **7**

OR

2. The overall transfer function of the control system is given as - **14**

$$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$

A step change of magnitude 6 is introduced into the system calculate,

i) Overshoot
ii) Period of oscillation
iii) Natural period of oscillation
iv) Rise time
v) Ultimate value of response
vi) Maximum value of response

3. The open loop transfer function of a control system is given as **13**

$$G(s) = \frac{Kc(0.5s+1)}{s(s+1)(s+0.5)}$$

sketches the root locus diagram of the control system. Indicate open loop poles, zero, breakaway point asymptotic lines the direction in which the loci travel. Determine the value of gain of the controller Kc. for which the system becomes just unstable.

OR

4. The open loop transfer function of a control system is given as - **13**

$$G(s) = \frac{Kc}{s(0.1s+1)(10s+1)}$$

Sketch the asymptotic Bode diagram of control system. Determine the value of Kc for which the control system is stable.

5. a) Describe the mechanism of proportional integral controller and derive the equation of transfer function for the same. **7**

b) Derive the response equation and offset equation for the proportional Derivative controller for servo-mechanism control problem. 6

OR

6. a) The unity feed back control system is given a step change of magnitude one to the set point. Determine the offset and the maximum value of the response of the over all transfer function is - 7

$$\frac{C(s)}{R(s)} = \frac{0.7}{s^2 + 0.6s + 1}$$

b) Discuss the working and industrial applications of the pneumatic control value with diagram. 6

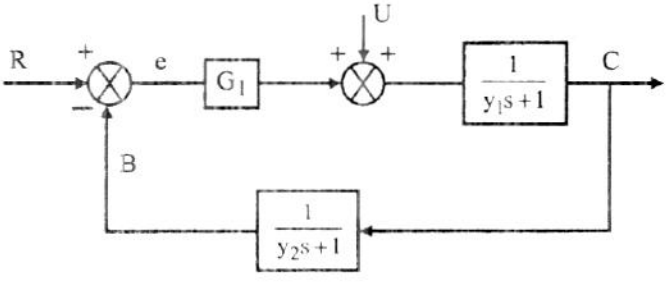
SECTION – B

7. a) What is servo & Regulator control problems? Discuss the servo-mechanism control problem for negative feed back system. 8

b) Explain feed forward control of drum boiler in chemical Industry. 5

OR

8. a) Obtain the transfer C(s)/R(s) for the block diagram shown. 5



b) Discuss Ziegler - Nichols optimum controller settings. 4

c) Explain Nyquist stability criteria. 4

9. a) Discuss the cascade control with characteristic equation with help of block diagram. 9

b) Explain cascade control used in heat exchanger to maintain the outlet temperature of stream? 5

OR

10. a) Discuss Ratio control and mention the examples of ratio control in chemical industries. 7

b) Explain with diagram feed forward control of distillation column. 7

11. Discuss the following control strategies in shell and tube heat exchanger- 13
i) By pass the process fluid. ii) Controlling medium flow rate.

OR

12. Discuss the following control of reactors. 13
i) Control of a CSTR. ii) Control of Tubular reactor.

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