Total No. of Questions : 8] *[Total No. of Printed Pages : 3*

Roll No .....

CM-6003-CBGS

B.E. VI Semester

Examination,December 2020

Choice Based Grading System (CBGS)

Chemical Process Control

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Assume suitable data wherever necessary.

1. a) Explain with the suitable example how the design of a feedback controller involves the compromise between the robustness and the accuracy
   b) Write the working principle of a reverse acting controller and give any appropriate example.
   c) Write the merits and demerits of ZN tuning method.

2. a) Describe the construction and working of the following pneumatic force balance controllers.
      i) ON-OFF
      ii) Proportional controller
      iii) PID
   b) What do you mean by process instrumentation diagrams and its symbols? Also explain process instrumentation in heat exchanger process equipment.

3. a) Explain with suitable examples feed forward and feed backward control configuration.
   b) Explain the transportation lag, how will you get its transfer function?

4. a) Explain the step response of two tank interacting multicapacity control systems.

   b) The transfer function of the second order control system is given as

$$G(s) = \frac{5}{2s^2 + 1.63s + 5}$$

   A step change of magnitude 5 is given in the imper variable of the system. Determine the overshoot, rise time, period of oscillation.

5. a) What is Root Locus? What is breakaway point in Root Locus?

   b) Explain bode diagram for first order system.

6. a) Determine the values, of K and k of the close loop system shown in Figure so that the maximum overshoot in unit-step response is 25% and the peak time is 2 sec. Assume that J=1 kg-m^2.

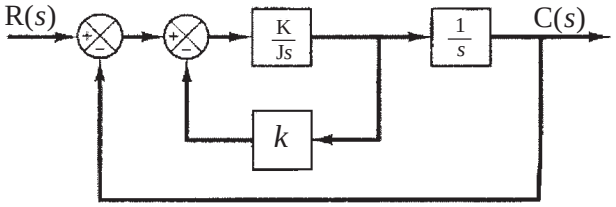

Figure : Closed-loop system.

   b) A second order control system has percentage overshoot, PO=11.219416. If the 5% settling time t=0.75
   Determine:
   i) The damping ratio of the system
   ii) The un-damped natural frequency
   iii) The characteristic equation for the control system
   iv) The damped natural frequency
   v) The peak time

7. a) What are the advantages of closed loop control system?
   b) What are some examples of closed-loop systems and open loop system in chemical engineering?

8. A proportional controller having gain k_c is to control two first order systems is having time constants $\tau_1 = 2$ and $\tau_2 = 3$ and it is unity feedback system. Determine the stability of control system using Routh's criterion.

******