Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PCCH 4304 (New)

Sixth Semester (Back) Examination – 2013

PROCESS DYNAMICS AND CONTROL

BRANCH : CHEM

QUESTION CODE : B310

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.
Assume suitable notations and any missing data wherever necessary.

1. Answer the following questions : 2×10

   (a) Define overshoot and ultimate period of oscillation.

   (b) Sketch the bode plot of a 1st order process.

   (c) Write the Bode stability criteria w.r.t. gain margin and phase margin.

   (d) What do you mean by tuning of controller ?

   (e) Write the Ziegler Nichols controller setting of a PID controller.

   (f) What do you mean by transient response ?

   (g) If a step change of set point of magnitude 0.4 is introduced to the following open loop transfer function, $G(s) = 1.2/(3s^2 + 2s + 3)$, find out the offset. Whether it is a Servo problem or regulatory problem.

   (h) What is transportation lag ?

   (i) If R is Resistance and C is capacitance, then time constant is given by _____.

   (j) Write the function of sampling switch and hold element.

2. (a) Prove that U-tube manometer is a second order instrument. 8

   (b) Define time constant. 2

3. (a) Sketch the actual Bode plot of control system having open loop transfer function given as : $G_{(s)} = \frac{k_c(5s+1)e^{-2s}}{(2s+1)(s+1)}$. 8

(b) Define the terms : Gain margin and Phase margin. 2

4. (a) "For a first order system if a proportional controller is used it exhibit an offset." Justify the statement. 5

(b) Derive the step response equation of a first order system when a sinusoidal input of magnitude 1 is introduced. 5

5. The open loop transfer function of a control system is given as :

$G(S) = K_C/s(s+1)(s+2)$

Draw the Root Locus diagram of the control system. Determine the gain of the controller K_C for which the system becomes just unstable. 10

6. With the help of process reaction curve method find the controller setting of PI controller if the open loop transfer function is given as : $\frac{1}{(s+1)^4}$. Solve this problem analytically. 10

7. (a) Draw the cascade control configuration of a jacketed Kettle. Draw the corresponding block diagram indicating primary and secondary controller. 5

(b) What is Smith predictor ? How is it used to reduce the effect of transportation lag parameter for the control system ? 5

8. Write short notes on any **two** : 5×2

(a) Frequency response analysis

(b) Routh-Hurwitz method

(c) Internal model controller

(d) Valve sizing.