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

Total number of printed pages – 2

B. Tech

PCCH 4304

Sixth Semester Back Examination – 2015

PROCESS DYNAMICS AND CONTROL

BRANCH : CHEM

QUESTION CODE : M 128

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.
Answer all parts of a question at a place.

1. Answer the following questions : 2×10
   (a) What are the objectives of a controller ?
   (b) Define time constant.
   (c) Define transfer function and write its significance.
   (d) Represent the following forcing function graphically.
   Step input of magnitude A and Impulse input of magnitude A.
   (e) What do you mean by transient response ?
   (f) Differentiate between servo and regulatory problem.
   (g) Define overshoot and rise time.
   (h) Write Routh's criterion for stability of a control system.
   (i) Define open loop poles and open loop zeros.
   (j) Write some applications of ratio controller.
2. (a) Prove that mercury in glass thermometer is a first order instrument. 8
   (b) Write the characteristics of a first order instrument. 2
3. A control system having transfer function is expressed as : 10

$$G(S) = 15/(10s^2 + 3s + 5)$$

The control system is subjected to a step change of magnitude 3. Calculate :
   (a) The value of Y(t) at t = 1min,
   (b) Offset and ultimate response, and
   (c) Overshoot, Decay ratio, and Maximum value of Y(t).

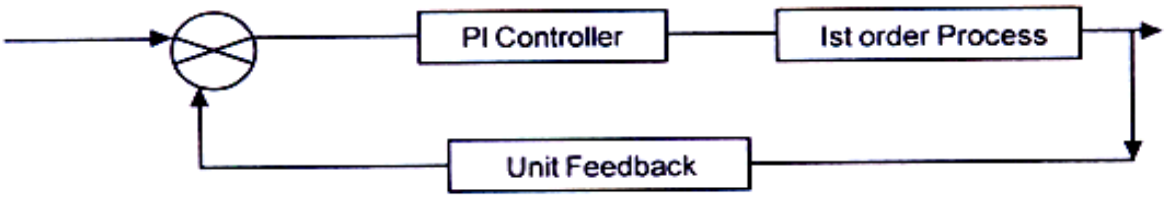
P.T.O.

4. The open loop transfer function of a control system is given as : 10

$$G(s) = \frac{K_c}{S(S+1)(S+2)}$$

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

5.



For the above closed loop system determine the closed loop response, ultimate response, and offset with step input of unit magnitude in the set point. Identify the type of control problem. 10

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

(b) Sketch the asymptotic bode diagram of control system having open loop transfer function given as : 6

$$G(s) = \frac{k_c(5s+1)}{(2s+1)(s+1)}$$

7. (a) Define pulse transfer function and find an expression for pulse transfer function for a first order system. 5

(b) With the help of process reaction curve method find the controller setting of PI controller if the open loop transfer function is given as $\frac{1}{(S+1)^2}$. Solve this problem analytically. 5

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

(a) Cascade control system for a heat exchanger

(b) Pneumatic controller

(c) Design of a sample data controller

(d) Routh – Hurwitz method of stability.
