BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
COMPREHENSIVE EXAMINATION (Closed Book)
BE (Hons) III year CHEM

Course No : CHE C441
Course Title : PROCESS CONTROL
Date : 26.05.2011 Time: 3Hours M.M = 70 (35%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.

1. a. An electronic PI controller is subjected to the error of 3, PB=80% & reset time as 2 min. Find the output when the controller output saturates.
b. What is meant by inferential control? Explain.
c. What are the basic elements & classifications of control valve?
d. Write the mass balance & component balance equation of feed tray in distillation column.
e. Find the degrees of freedom for stirred tank heater.

[5*2=10M]

2. Find the overall transfer function for the non interacting system shown in Figure (1). Apply step input to the transfer function and find the response. **[10 M]**

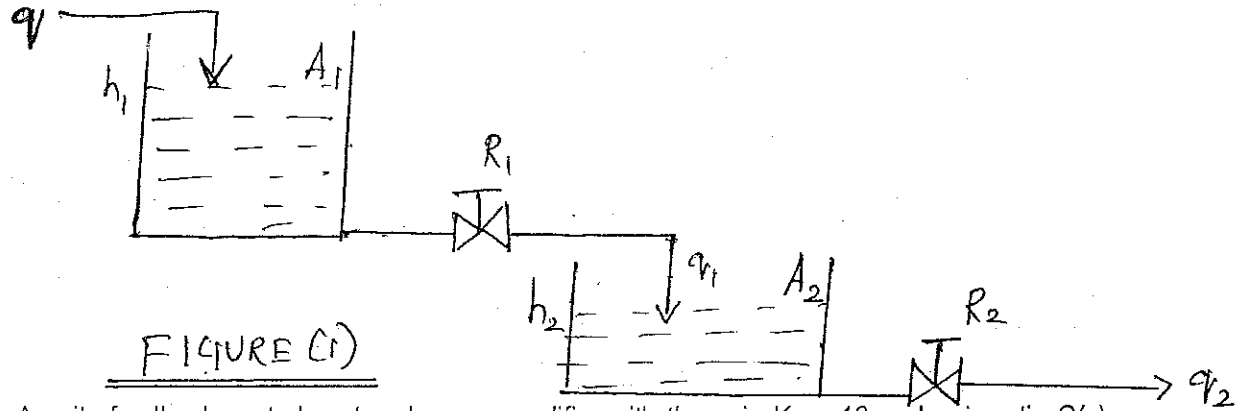

FIGURE (1)

3. A unity feedback control system has an amplifier with the gain K_A = 10 and gain ratio G(s) = 1/s(s+2) in the feed forward path as shown in Figure (2). A derivative feedback, H(s) = sK_0 is introduced as a minor loop around G(s).Determine the derivative feedback constant K_0 so that the system damping factor is 0.6. And also find the undamped natural frequency. **[10 M]**

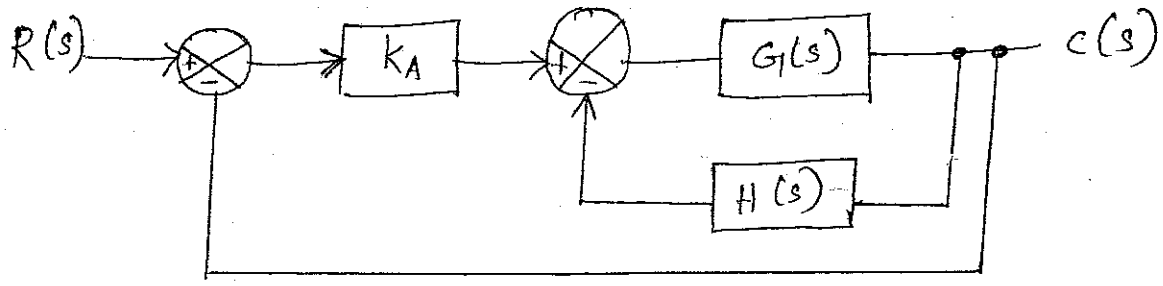

FIGURE (2)

4. Consider a process model which has the open loop transfer function with a unity feed back system G(s) = (1+0.2s)(1+0.025s)/ s^3 (1+0.005s)(1+0.001s). Sketch the polar plot and determine the phase margin. **[10 M]**

5. A process (including valve and transmitter) has the following transfer function. Obtain the gain cross over frequency by bode diagram. G(s) = 5 (1+2s) / (1+4s)(1+0.25s). (Assume the lower frequency as 0.1 rad/ sec & High frequency as 10 rad/sec. **[10 M]**

6. Using Hebb rule, train the OR Gate to the neural network. Try the maximum possible ways and indicate your comments. The order of the training is

X_1	X_2	
1	1	
1	0	
0	1	
0	0	**[10 M]**

7. Find G(s) for a pure capacitive process shown in Figure (3). And also find its dynamic response when it is subjected to unit step input. **[10 M]**

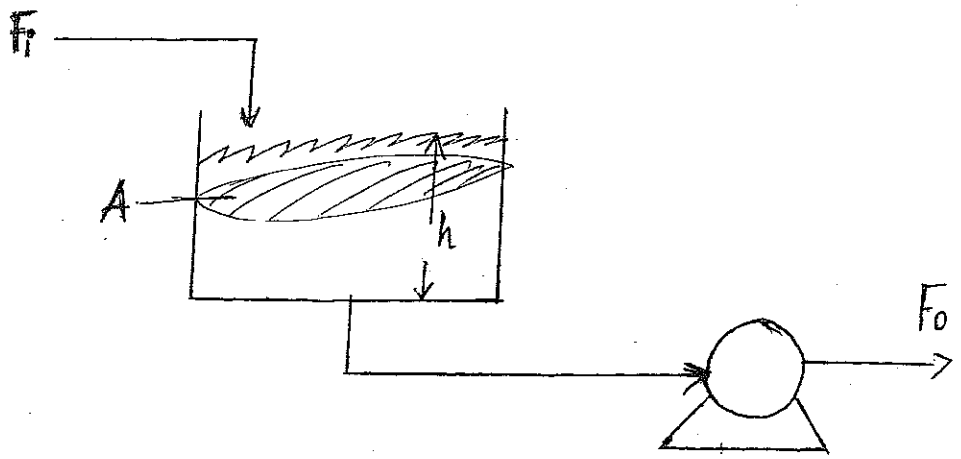

FIGURE (3)

ALL THE BEST

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
TEST II (Closed Book)
BE (Hons) III year CHEM

Course No : CHE C441
Course Title : PROCESS CONTROL
Date : [redacted] 08.05.2011 Time: 50 Minutes M.M = 20 (20%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.
3. Text book and hand written class notes are allowed.

1. A process (including valve and transmitter) has the following transfer function. Obtain the gain cross over frequency by bode diagram. G(s) = 20 / s (1+3s) (1+4s). (Assume the lower frequency as 0.15 rad/ sec & High frequency as 1 rad/sec. [8 M]

2. Consider a process model which has the open loop transfer function with a unity feed back system $G(s) = 1/s (1+s)^2$. Sketch the polar plot and determine the phase and gain margin. [8 M]

3. Determine the range of K for stability of unity feedback system whose open loop transfer function is G(s) = K/ s (s+1) (s+2). [4 M]

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BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
TEST I (Closed Book)
BE (Hons) III year CHEM

Course No : CHE C441
Course Title : PROCESS CONTROL
Date : 20.03.2011 Time: 50 Minutes M.M = 25 (25%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.

1. Develop the mathematical model and the input- output model for the stirred tank heater shown in figure 1. [6M]

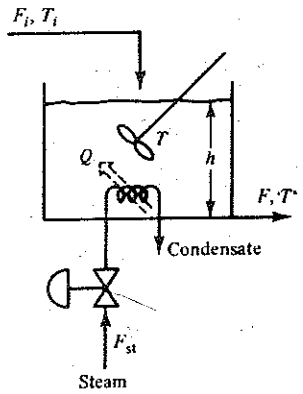

Fig (1) Stirred tank heater.

2. Find the degrees of freedom for the binary distillation column shown in figure 2. [6M]

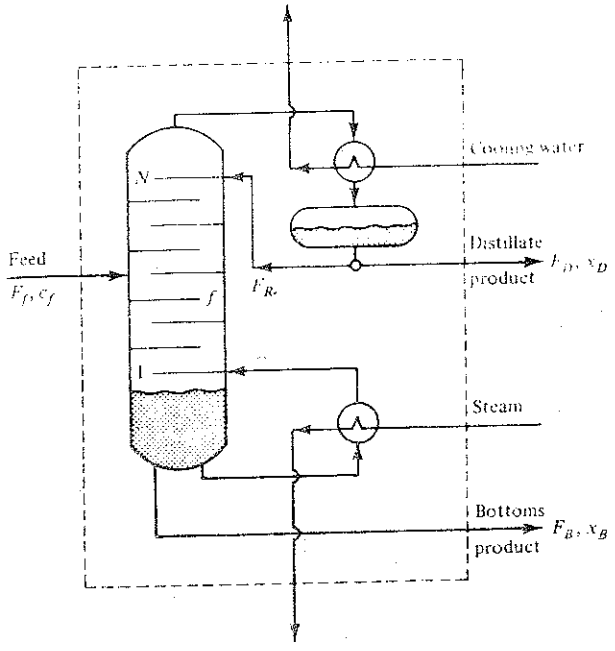

Fig (2) Binary distillation column.

PTO

3. a. An integral controller is used for speed control with a set point of 12 rpm with in a range of 10 to 15 rpm. The controller output is 22% initially. The constant K_I = -0.15% controller output per second per percentage error. If the speed jumps to 13.5rpm, calculate the rate of controller output change & controller output after 2 sec's for a constant e_p. [3M]

b. The hot material demand changes from a flow of 1.3 to 1.8m/min. If the controller output is normally 50% with a constant of Kp =12% per percentage for the set temperatures, then calculate the new controller output and offset error. Assume a temperature/ flow scale factor of 0.028% controller output. [4M]

4. A unity feed back control system has an open loop transfer function G(s)= 10/s (s+2). Find the rise time, percentage overshoot, peak overshoot, peak time and settling time for a step input of 12 units.

[6M]

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BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
QUIZ I (Closed Book)
BE (Hons) III year CHEM

Course No : CHE C441
Course Title : PROCESS CONTROL
Date : 09.03.2011 Time: 20 Minutes M.M = 16 (8%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.

1. Define Neutral Zone.

2. Draw the graphical representation of sinusoidal input and the corresponding final Control element output for three position mode control.

3. Define Integral Control action.

4. What is the disadvantage of three mode controller?

5. In an open loop transient response method, T_I = ... for the PI mode.

6. In ultimate cycling method, for Quarter Amplitude criterion the T_I is calculated as .....for PID mode.

7. Which controller is used for Temperature control process?

8. How will you calculate the critical time and critical gain in frequency response method for tuning a controller?

9. ITAE stands for ..... & when it is used?

10. For which type of process, the Cohen coon method is used for tuning a controller?

11. Feed forward control is used independently. Say yes or No. Justify your answer.

12. What is the condition for cascade control system?

13. What is the offset that results from 10% change in 'P' Controller output when proportional gain is 0.5?

14. What is the status of settling time in Preact control and why?

15. Define Reset Time.

16. Which type of control system is the sub division of feed forward control system?