Name_____Code_____

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester I   Academic year: 2007
Date: 6 October 2007   Time: 9.00-12.00
Subject: 230 – 425 Process Dynamics and Control   Room: R300

ทุจริตในการสอบ โทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

- **Only hand written note in a sheet of A4, a dictionary and calculator are allowed.**
- There are 9 pages of the exam.
- Write your name or your code on each page.
- If need to write the answers on the back of each page, please identify the problem number.

| Problem Number	Score	
1	40	
2	20	
3	40	
4	40	
5	20	
Total	160	

Dr. Kulchanat Prasertsit

1. (40 points) Tank level is measured by different pressure transmitter and controlled by quick opening control valve on the effluence flow. The control valve is air to close type and controller is PI controller which K_c= 0.5 and integral time constant is 5 min. The different pressure transmitter is used to measure the tank level between 5 and 25 cm and convert to the signal of 3 to15 psi. The normal tank effluent flow is 20 gpm at valve life of 0.5 (a constant pressure drop across the valve of 36). If the level is suddenly decrease by 5 cm from the steady state, after 1 minute of the change;

1.1 Calculate the transmitter gain.

1.2 Specify controller actions (Reverse or direct active), controller bias and calculate the controller output.   .

1.3 Calculate the air life of control valve.

1.4 Calculate the tank effluent flowrate.

2. (20 points) From a root locus described a process in the figure below

2.1 Determine **pole** and **zero** of the process:

       Pole at_____, Zero at_____

2.2 At gain K, Damping factor=_____, ω = _____

Root Locus
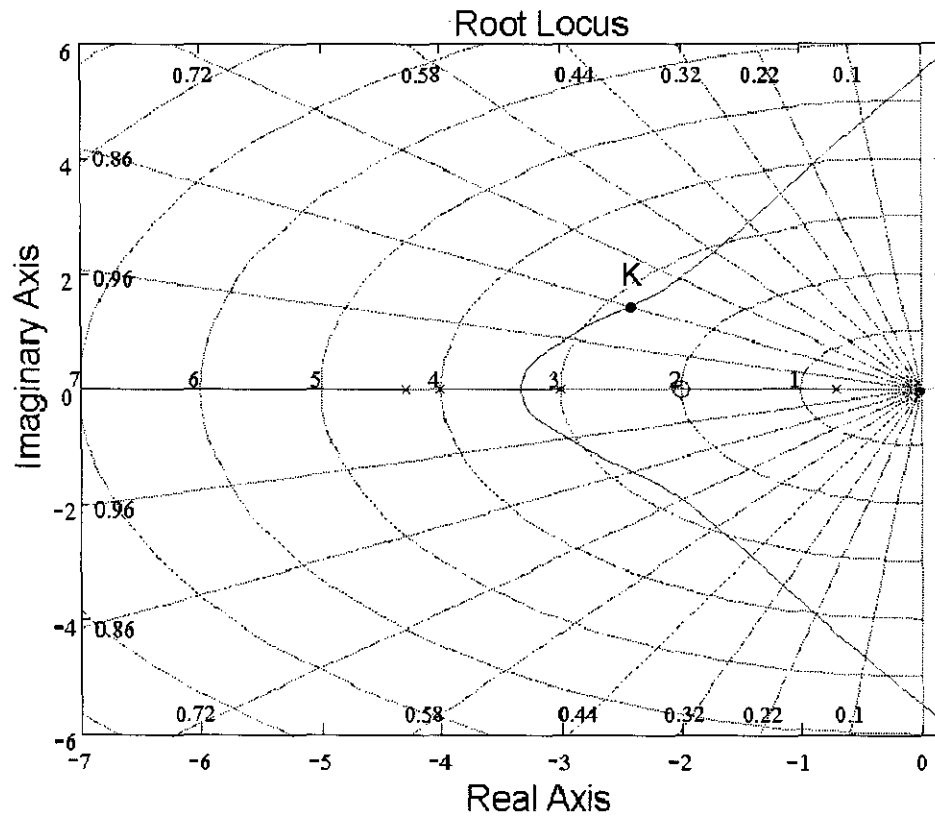
3. (40 points) The transfer function of the process is given by $G_p = \dfrac{(s+1)e^{-s}}{(s+2)(s+3)}$

3.1 Use Routh array to find the range of Kc for P controller which makes the process stable.

3.2 Use direct substitution method to find ultimate gain and ultimate frequency.

Give: Pade' Approximation of deadtime $e^{-\theta s} = \dfrac{1-\dfrac{\theta}{2}s}{1+\dfrac{\theta}{2}s}$

4 (40 points) The transfer function of the process is given by $G_p = \dfrac{(s+1)e^{-s}}{(s+2)(s+3)}$ Find P controller gain which makes the process has gain margin of 2.0 and phase margin of 50°. And sketch the Bode diagram.

5 (20 points) Name 2 control structures (Ratio control, cascade control, override control).

Primary Loop

A
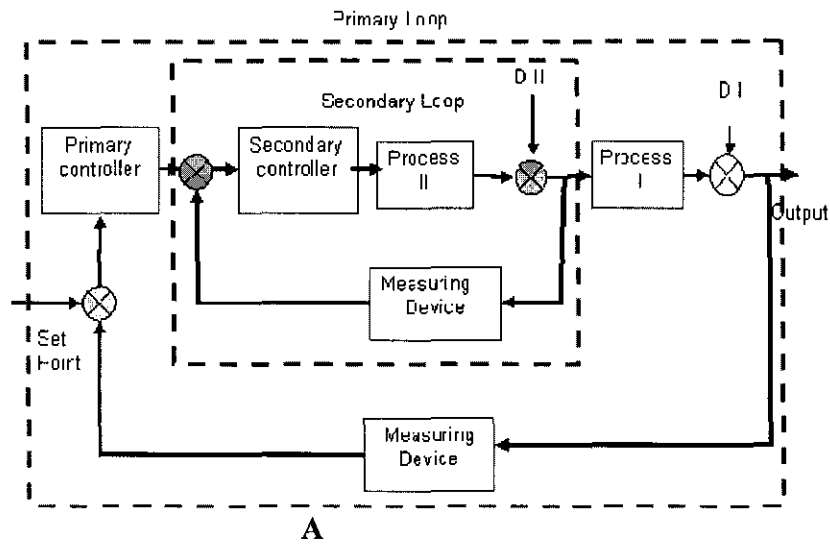
The control structure **A** is called _____
Brief of this structure.

B
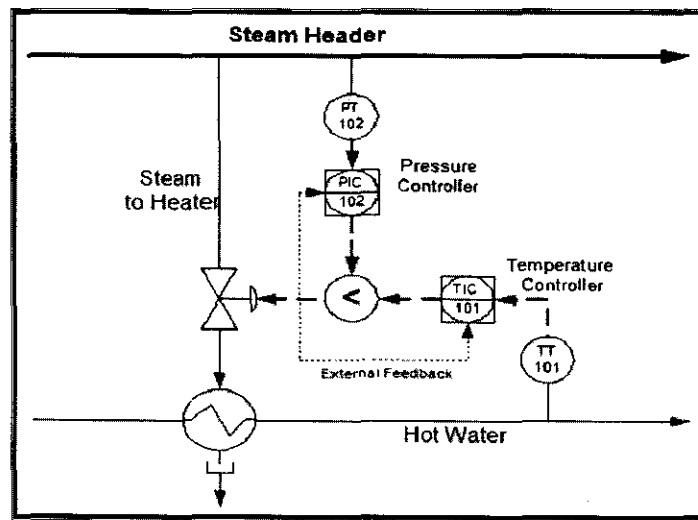
The control structure **B** is called _____
Brief of this structure.