PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 1 Academic Year: 2009
Date: September 29, 2009 Time: 9.00-12.00
Subject: 226-433: Industrial Automatic Control Room: R300

Instructions

- There are 5 questions in 4 pages.
- Attempt all questions, write your answers in the book provided.
- Only the hand-written note on a 2-sided A4 sheet and a calculator are allowed. *Dictionary is not allowed.*
- Total score is 100.

Name:	Student ID.....

Question #	Full Score	Assigned Score
1	**15**	
2	**20**	
3	**20**	
4	**25**	
5	**20**	
Total	**100**	

Assoc. Prof. Somchai Chuchom

Name.....ID.....

Question #1 (15 marks) Briefly explain the following questions.

1.1 What is overshoot? How to reduce it?

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1.2 Specify the parameters indicating the performance of the control system at the transient state.

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1.3 What are the dominant poles?

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1.4 BIBO stability means .....
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1.5 What is damping ratio ? .....
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1.6 What is PLC? Explain the concept and the purpose of applying PLC in the manufacturing industry.

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Question #2 (20 marks)

Find the steady-state error for the unit step input, u(t) to the system shown in Figure 1

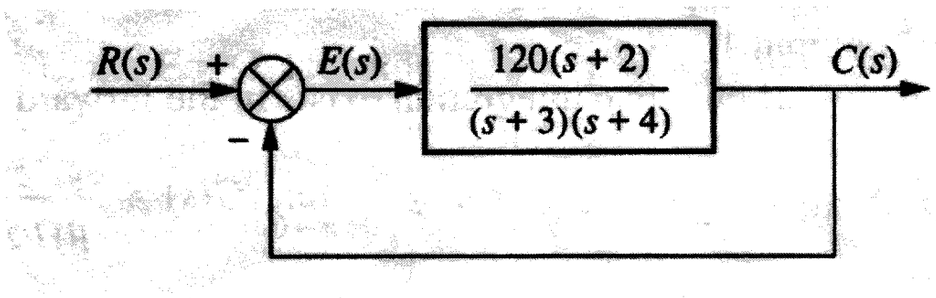

Figure 1

Question #3 (20 marks)

Determine the range of K for stability of the control system shown in Figure 2.

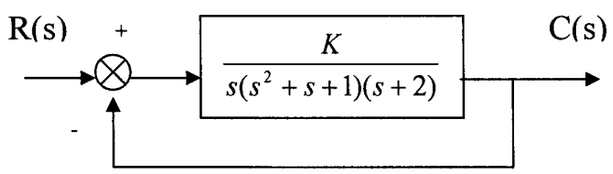

Figure 2

Question #4 (25 marks)
Given a feedback system whose open-loop transfer function is

$$\frac{K(s+20)}{(s+2)(s+4)(s+10)},$$

where K is the feedback gain. Apply the root-locus technique to evaluate the system's closed-loop behaviors;

a) The number of asymptotes, the asymptote angles, and the asymptotes' real-axis intercept.
b) Sketch the root-locus and indicate all information needed for it.
c) What you have learned from the root-locus sketch in b)?

Question #5 (20 marks)
A negative feedback control system has a transfer function

$$G(s) = \frac{K}{(s+3)},$$

We select a compensator

$$G_c(s) = \frac{s+a}{s},$$

in order to achieve zero steady-state error for a step input. Select a and K so that the overshoot to a step is approximately 5% and the setting time (with a 2% criterion) is approximately 1 second.