PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid-term Examination: Semester 2 Academic Year: 2005
Date: December 10, 2005 Time: 9:00-12:00
Subject: 226-331 Industrial Automatic Control Room: A400

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

Instruction

1. **Attempt all questions in this exam paper.**
2. **A closed-book exam., No sheets or any materials is allowed.**
3. **A calculator and a dictionary are allowed.**
4. **The scores are summarized in following table.**

Question	Full score	Assigned score
1	10	
2	10	
3	10	
4	10	
5	5	
Total	*45*	

Asst. Prof. Somchai Chuchom

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Question 1

1.1) Identify the components, inputs and outputs, and describe the operation of biological control system consisting of a human being reaching for an object. (5 marks)

1.2) Draw a block diagram for the human reaching for an object system above. (5 marks)

Question 2 (10 marks)

A high-precision positioning slide is shown in Figure E2.20. Determine the transfer function $X_p(s)/X_{\text{in}}(s)$ when the drive shaft friction is $b_d = 0.7$, the drive shaft spring constant is $k_d = 2$, $m_c = 1$, and the sliding friction is $b_s = 0.8$.

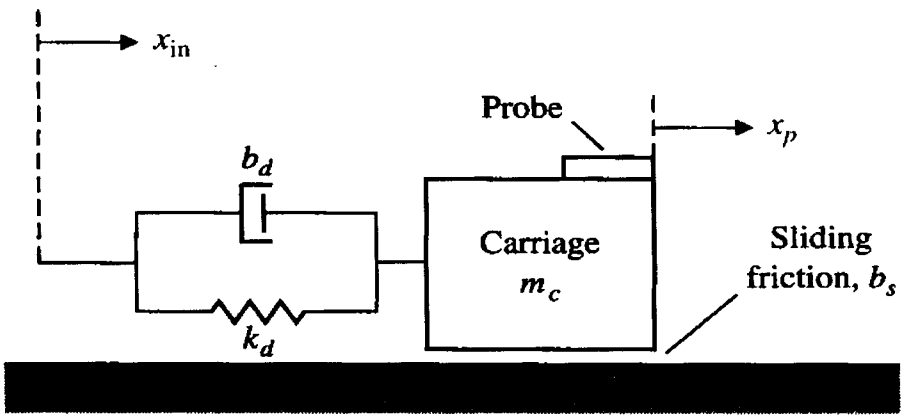


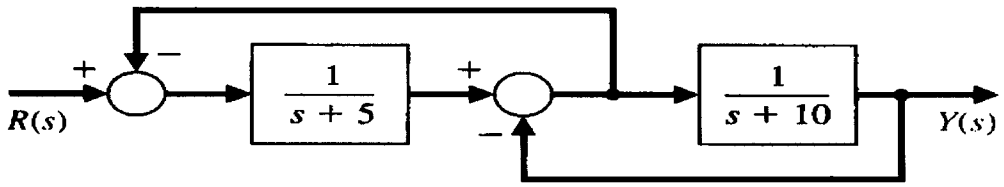
FIGURE E2.20 Precision slide.

Question 3 (10 marks)

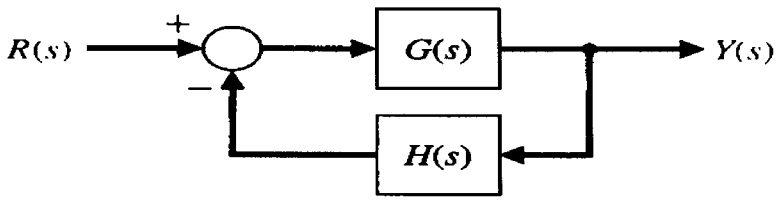
A system is shown in Fig. E2.28(a).

(a) Determine $G(s)$ and $H(s)$ of the block diagram shown in Figure E2.28(b) that are equivalent to those of the block diagram of Figure E2.28(a).

(b) Determine $Y(s)/R(s)$ for Figure E2.28(b).



(a)

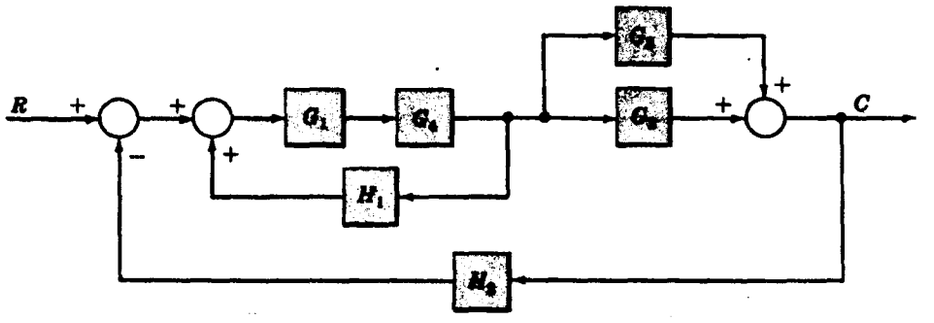


(b)

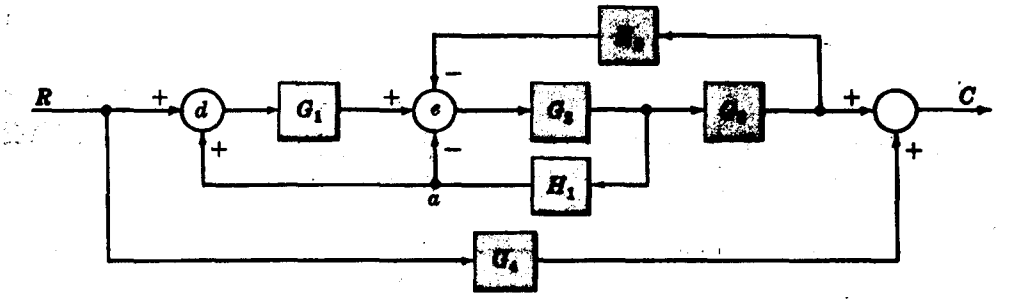
FIGURE E2.28

Question 4 Simplify the following block diagrams.

4.1) (5 marks)



4.2) (5 marks)



Question 5 (5 marks)

The suspension system for one wheel of an old-fashioned pickup truck is illustrated in Figure P2.35. The mass of the vehicle is m_1 and the mass of the wheel is m_2. The suspension spring has a spring constant k_1, and the tire has a spring constant k_2. The damping constant of the shock absorber is b. Obtain the transfer function $Y_1(s)/X(s)$, which represents the vehicle response to bumps in the road.

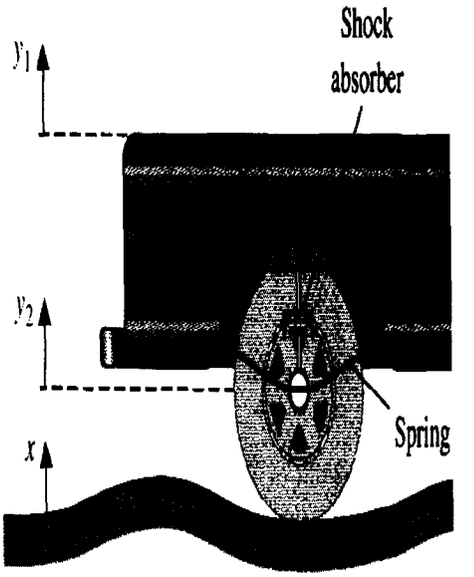


FIGURE P2.35 Pickup truck suspension.