

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid-term Examination: Semester 1

Academic Year: 2011

Date: August 7, 2011

Time: 9:00-12:00

Subject: 226-433 Industrial Automatic Control

Room: A401

NameID

Instruction

1. Attempt all 5 questions in this exam paper.
2. A closed-book exam., No sheets or any materials is allowed.
3. A calculator is allowed.
4. The scores are summarized in following table.

Question	Full score	Assigned score
1	15	
2	15	
3	15	
4	15	
5	15	
<i>Total</i>	75	

Assoc. Prof. Somchai Chuchom

ทูลรตในการสอบ โทษขันต่ำคือ ปรบตกลในรายวชทที่ทูลรต และพัทการเรยน 1 ภาคการศกษา

Question #1 (15 marks) Answer the following questions

1.1) (5 marks) What is the control system? Explain each of the control system elements.

1.2) (5 marks) What are the advantages and limitations of the open-loop control systems? Give examples of at least 2 open-loop control systems – explain their concepts and components involved.



1.3) (5 marks) Consider the Machining Center (MC) located in the CAD/CAM laboratory of IE department. What sub-systems of the MC are the automatic control systems? Why? For each sub-system, specify the suitable actuators and sensors.

Question #2 (15 marks)

A laser printer uses a laser beam to print copy rapidly for a computer. The laser is positioned by a control input, $r(t)$, so that we have

$$Y(s) = \frac{5(s + 100)}{s^2 + 60s + 500} R(s).$$

The input $r(t)$ represents the desired position of the laser beam.

- 2.1 If $r(t)$ is a unit step input, find the output $y(t)$.
- 2.2 What is the final value of $y(t)$?

Name ID

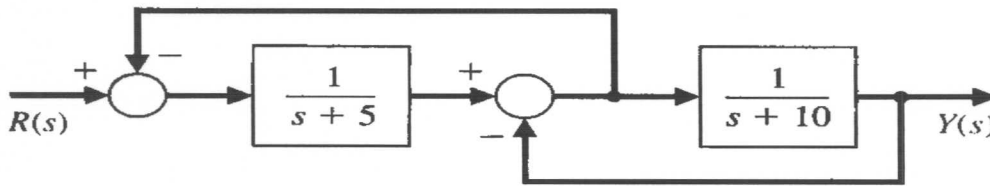
Handwritten signature or initials, possibly 'OK' or similar, in the bottom right corner.

Question #3 (15 marks)

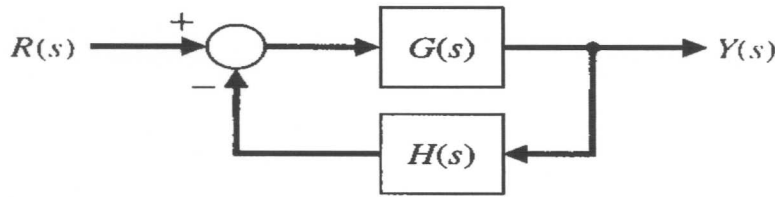
A system is shown in Figure 1(a).

3.1 Determine $G(s)$ and $H(s)$ of the block diagram shown in figure 1 (b) that are equivalent to those of the block diagram of Figure 1(a).

3.2 Determine $Y(s)/R(s)$ for Figure 1(b).



(a)



(b)

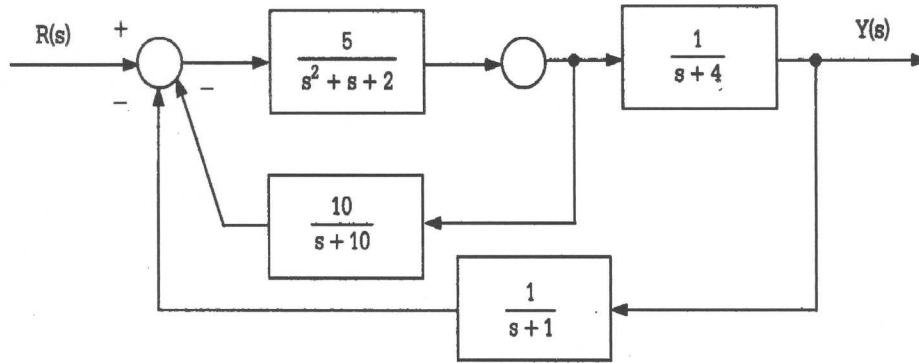
Figure 1

Name ID

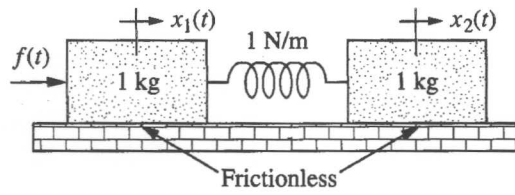


Question #4 (15 marks)

4.1) (7 marks) Simplify the following block diagrams below.



4.2) (8 marks) Find the Transfer function, $G(s) = X_2(s)/F(s)$, for the translational mechanical system shown below.



Question #5 (15 marks)

Solve the differential equation below, assume zero initial conditions.
Also show the Transfer function, poles and zeros of the mathematical model.

$$\frac{d^2x}{dt^2} + 8\frac{dx}{dt} + 15x = 7u(t)$$

- 5.1) Using classical methods.
5.2) Using Laplace transforms.

Name ID