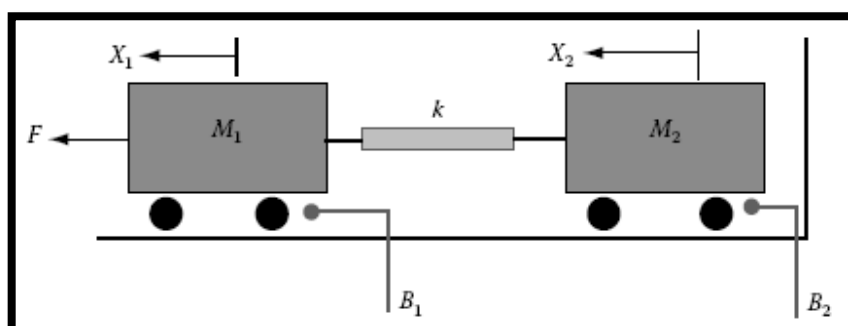
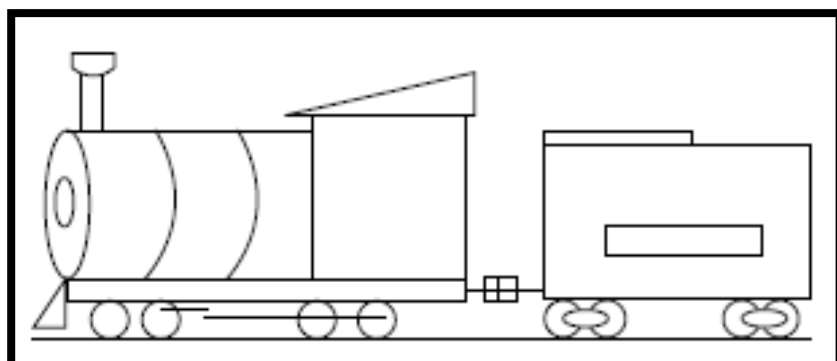


Mansoura University		Computer Engineering and Control Syst. Dept. Total Marks: 90 Marks	Faculty of Engineering
Course Title: Control Engineering 1	حديث وتطبيقات	Course Code: CSE 3116	No. of Pages: 02
Date: 11 Jan. 2017	Allowed time: 3 hr.		
Remarks: (Answer the following questions... assume any missing data)			

Question No. 1

15 Marks

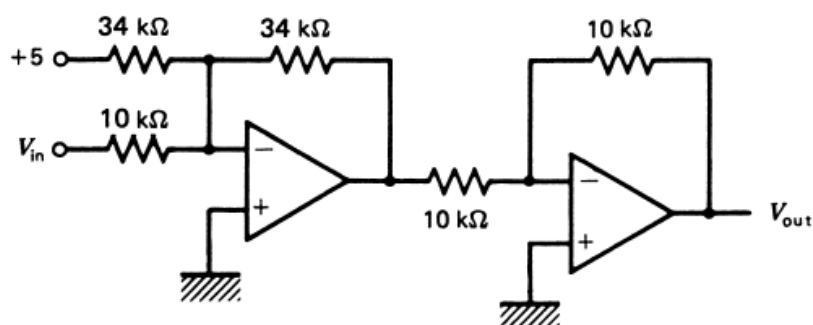
Consider a toy train consisting of an engine and a car as shown. Assuming that the train travels only in one direction, we want to apply control to the train so that it has a smooth start-up and stop and a constant-speed ride. The mass of the engine and the car will be represented by M_1 and M_2 , respectively. The two are held together by a spring, which has the stiffness coefficient of k . F Represents the force applied by the engine, and μ represents the coefficient of rolling friction where $B_1 = \mu M_1 g$ and $B_2 = \mu M_2 g$. Sketch the Block Diagram



Question No. 2

15 Marks

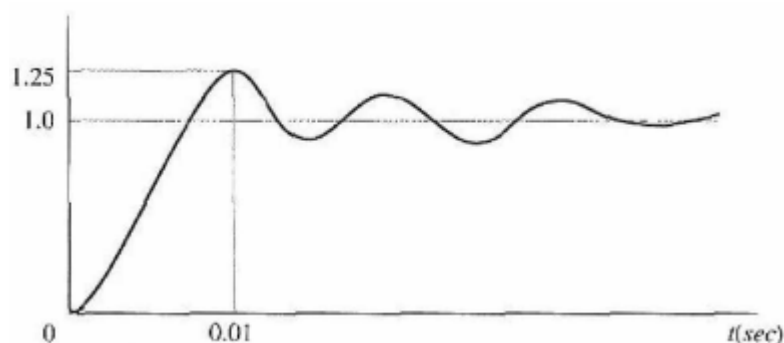
find the equation the govern the relation between V_{out} and V_{in}



Question No. 3

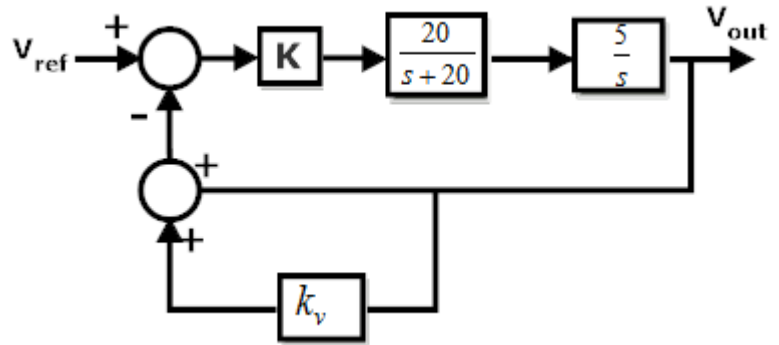
15 Marks

The unit-step response of a linear control system is shown in Fig. below. Find the transfer function of a second-order prototype system to model the system.



Question No. 4**15 Marks**

Figure below shows a typical control system using velocity feedback. Develop the closed-loop transfer function.

**Question No. 5****15 Marks**

A. The following transfer function is given for a single loop non-unity feedback control system.

$$G(s) = \frac{1}{s^2 + s + 2} \quad H(s) = \frac{1}{s + 1}$$

- Find K_p , K_v , and K_a
- Find the steady-state error for a unit-step input
- Under what conditions your answer in point (b) is valid
- State the system type

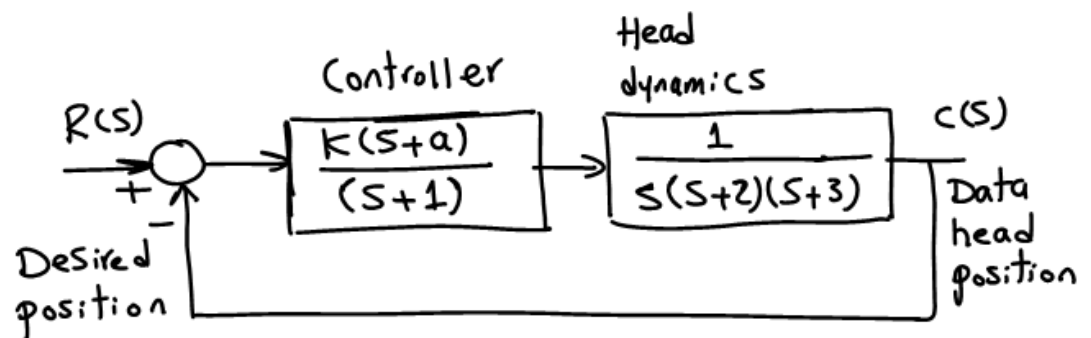
B. A negative feedback system has a loop transfer function

$$GH(s) = \frac{K(s + 2)}{s(s - 2)}$$

- Find the value of the gain when ζ of the closed-loop roots is equal to 0.707
- Find the value of the gain when the closed-loop system has two roots on the imaginary axis

Question No. 6**15 Marks**

Large disk-storage devices are used with today's computers. The data head is moved to different positions on the spinning disk and rapid, accurate response is required. A block diagram of a disk-storage data-head positioning system is shown. It is desired to determine the range of K and a for which the system is stable



Best wishes

Mostafa Elhosseini