



الفرقة: الثالثة  
الدرجة: ١٠٠

الزمن: ٣ ساعات  
الشعبة: هندسة كهربيه

جامعة المنوفيه  
كلية الهندسة- شبين الكوم  
قسم الهندسه الكهربيه  
الماده: نظم التحكم و تطبيقاتها  
التاريخ: ٢٠١٥ / ١١ / ٢٠

### Answer the following question:

1) A- A servo mechanism as shown in Fig. 1 ,

1 : Determine the transfer function of each element and the overall transfer function , and , ( 15 Marks )

2 : Draw the equivalent block diagram of the servo mechanism .

B - Determine the overall transfer function  $C ( s ) / R ( s )$  of the control system shown in Fig. 2. ( 5 Marks )

2) A- Figure ( 3 .a ) shows a mechanical vibratory system . When 2 Ib a force ( step-input ) is applied to the system , the mass ( m ) oscillates as shown in Fig ( 3.b ) . Determine m , f , and k of the system from this response curve . ( 10 Marks )

B - Consider the system shown in Fig 4 . Determine the range of k for stability. ( 10 Marks )

3) The open loop transfer function of unity feedback as :

$$G ( s ) H ( s ) = \frac{k}{s ( s^2 + 4s + 5 )} , H ( S ) = 1$$

A - Sketch the root loci for the system . Observe that for small or large values of K the system is underdamped and for medium values of K it is over damped , then , discuss this observation and describe the system stability at each zone . ( 15 Marks )

B - Determine the value of K so that the damping ratio  $\zeta$  of a pair of dominant complex conjugate closed loop poles is 0.5 . ( 5 Marks )

- 4) Obtain the phase and gain margins of the following control system as :

$$G(s)H(s) = \frac{K}{s(s+1)(s+5)}, H(s) = 1$$

For two cases where  $K = 10$  and  $80$ , and, check the system stability in each case. (20 Marks)

- 5) Consider the following control system, the open loop transfer function is given by

$$G(s)H(s) = \frac{K}{s(s+1)(0.4s+1)}, \text{ and } H(s) = 1$$

It is desired to compensate the system so that the static velocity error coefficient  $K_v = 5 \text{ sec}^{-1}$ , the phase margin is at least  $36^\circ$ , and the gain margin is at least 10 db. (20 Marks)

*All the best*  
**M. N. SERAG**

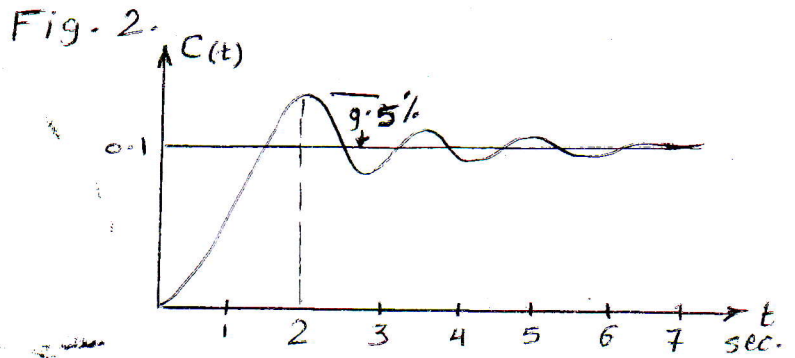
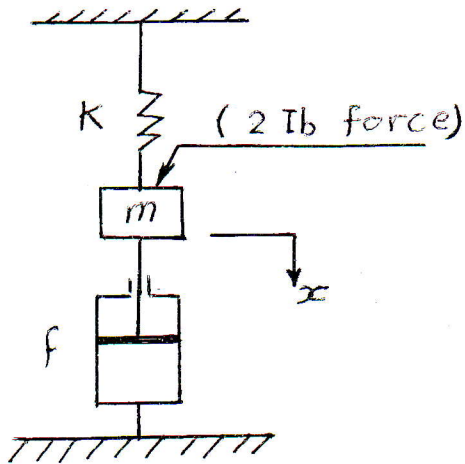
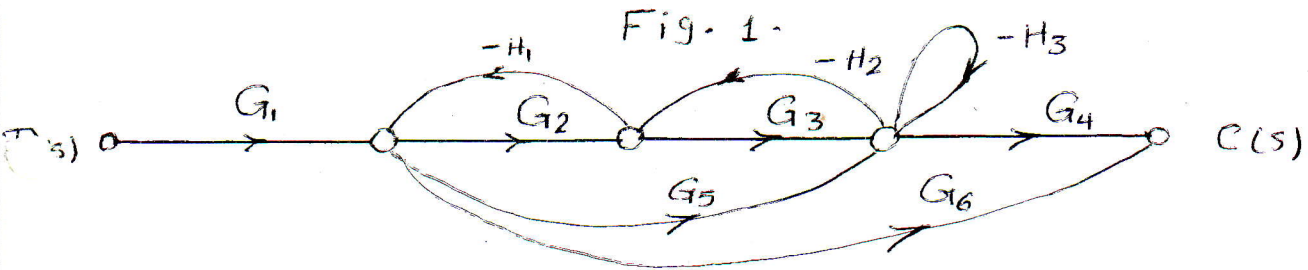
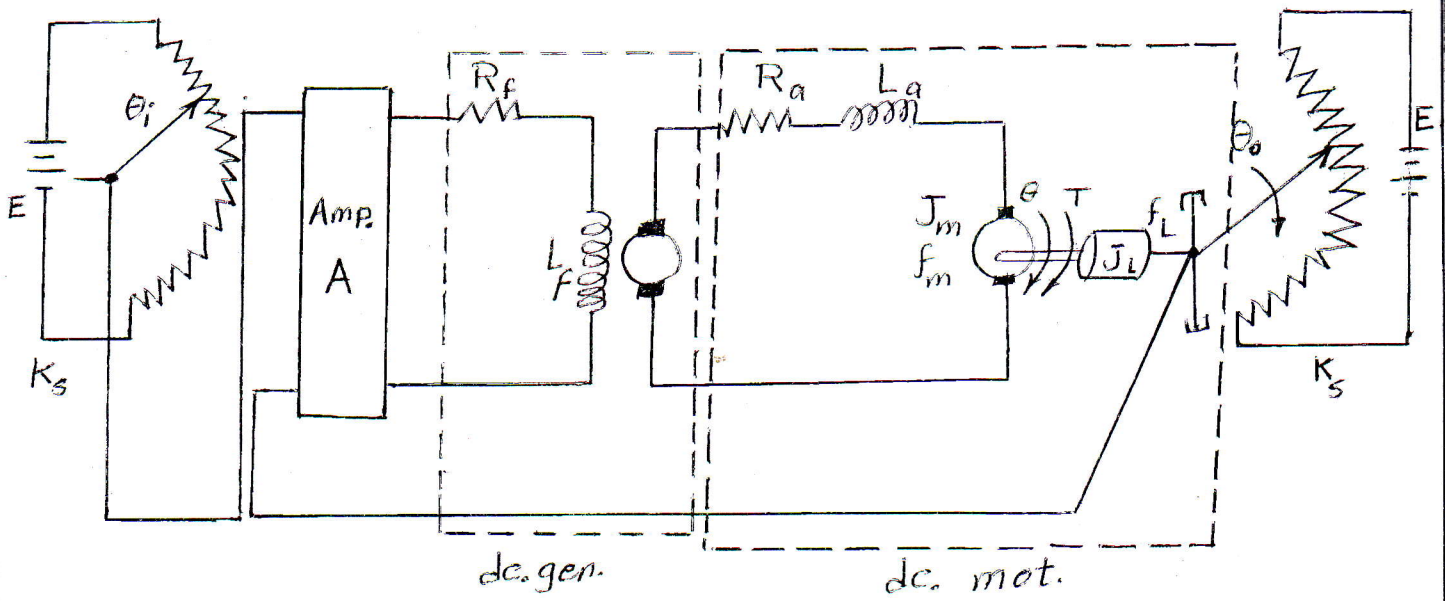


Fig. (3-a)

Fig. (3-b)

