逢甲大學100學年度碩士班招生考試試題 編號：067 科目代碼：233

科目	控制系統	適用系所	自動控制工程學系	時間	100分鐘

※請務必在答案卷作答區內作答。 共 2 頁第 1 頁

1. A non-minimum phase system is $G(s)=\dfrac{k(1-T_d s)}{s(Ts+1)}$, $H(s)=1$. Show that a part of the root-locus is circular, and find the range of k such that closed-loop system is stable. (10%)

2. Consider one tachogenerator feedback system shown in Fig. 1. (15%)
   (a) When $k_t=0$, find ω_n and ζ, for $r(t)=t$, $e_{ss}=?$
   (b) Determine the value of k_t such that system with $\zeta=0.6$ and find the e_{ss} again, for unit ramp input.
   (c) Adjust the values of k and k_t such that system with $\zeta=0.6$ and e_{ss} as part (a) for unit ramp input.

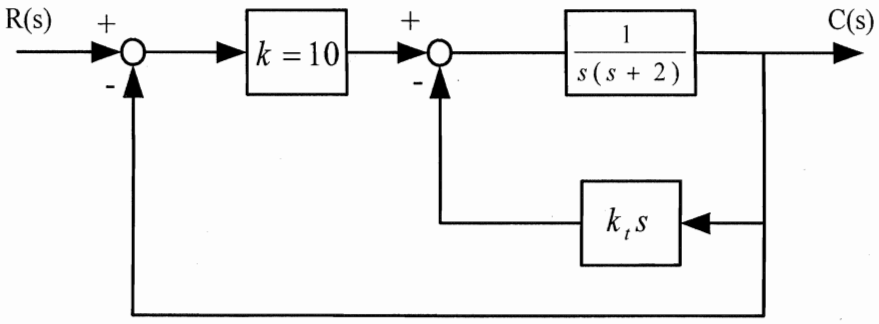


Fig. 1

3. Consider the feedback control system shown in Fig. 2. (15%)
   (a) Determine the range of k such that the system is stable.
   (b) Find the range of k such that the position error ≤ 0.1 (i.e. if $R(s)=\dfrac{1}{s}$, $|e_{ss}|\le 0.1$).
   (c) Find the range of k such that the overshoot $M_p \le 0.05$.

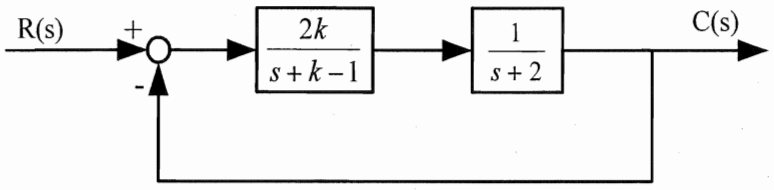


Fig. 2

4. Consider a unity negative feedback control system with open loop transfer function as $G(s)=\dfrac{k}{s(1+0.2s)(1+0.05s)}$. (10%)
   (a) Find the value of k such that the system with gain margin G.M. = 20 db.
   (b) Find the value of k such that the system with phase margin P.M. = 30°.

5. Find the state transition matrix of the following state equation: (15%)

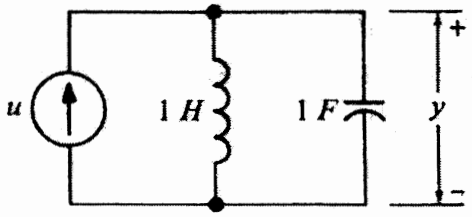
$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ t & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

6. Check the controllability and observability of the following dynamical equation: (10%)

$$\dot{\mathbf{x}} = \begin{bmatrix} 0 & 4 & 3 \\ 0 & 20 & 16 \\ 0 & -25 & -20 \end{bmatrix} \mathbf{x} + \begin{bmatrix} -1 \\ 3 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} -1 & 3 & 0 \end{bmatrix} \mathbf{x}$$

7. Consider the following network: (10%)



(a) Find the state equation of the network.
(b) Is it asymptotically stable?

8. Consider the following dynamical equation: (15%)

$$\dot{\mathbf{x}} = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \mathbf{x}$$

(a) Find the controllable canonical form of the system.
(b) If the system is controlled by a state feedback $u(t) = r(t) + \mathbf{k}\mathbf{x}(t)$, where $\mathbf{k} = \begin{bmatrix} k_1 & k_2 \end{bmatrix}$, find the values of k_1 and k_2 such that the closed-loop system has repeated poles.