109VE03

國立臺北科技大學 109 學年度碩士班招生考試

系所組別：1302 車輛工程系碩士班

第二節　自動控制　試題（選考）

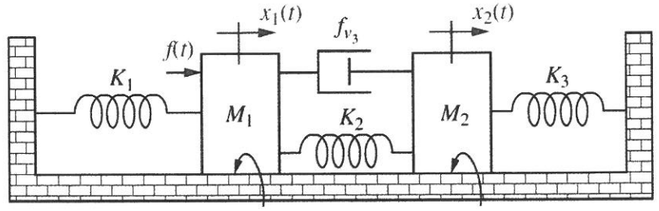
注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. For the following mechanical system, find the transfer function

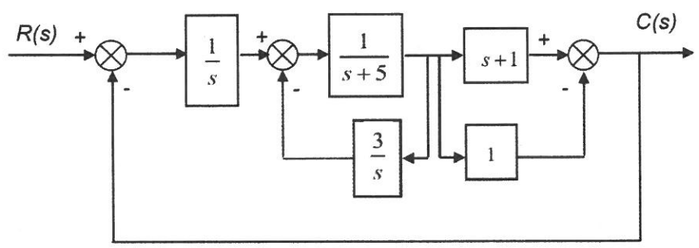
   a. Find the transfer function $G(s)=\dfrac{X_2(s)}{F(s)}$. (10%)

   b. Find the state equations representation of the system. (10%)



Frictionless Ground

2.



   a. For the above system, find the transfer function $T(s)=\dfrac{C(s)}{R(s)}$ (10%)

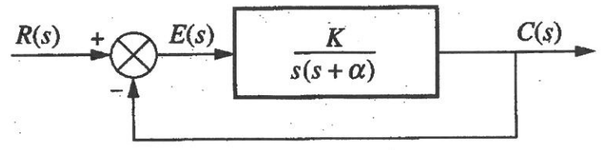
   b. Convert the block diagram into the signal flow graph representation. (5%)

   c. Use Mason's gain formula to find the transfer function $T(s)=\dfrac{C(s)}{R(s)}$ (5%)

3. For the following system

   a. Find K and α to yield a settling time of 0.1 second and a 20% overshoot. (10%)

   b. Find the time response $c(t)$ when the input $R(s)=\dfrac{1}{s}$. (10%)



4. For the system :

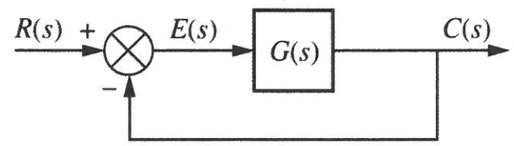
$$\frac{Y(s)}{R(s)}=\frac{(s+1)}{s^3+2s^2+s+K}$$

   a. By Routh-Hurwitz criterion, find the range of K for which the system is stable. (10%)

   b. When the input $R(s)=\dfrac{1}{s}$, determine the steady-state error $e_{ss}=\lim_{t\to\infty}e(t)$. (10%)

   (Note: e(t)=r(t)-y(t)).

5. Consider the unity feedback system



with the forward transfer function

$$G(s)=\frac{K}{s(s+3)(s+10)}$$

The system is operating at 20% overshoot. Design a compensator to decrease the settling time by a factor of 2 without affecting the percent overshoot and do the following:

   a. Evaluate the uncompensated system's dominant poles, gain, and settling time. (10%)

   b. Evaluate the compensated system's dominant poles and settling time. (10%)