1094T03

國立臺北科技大學 109 學年度碩士班招生考試

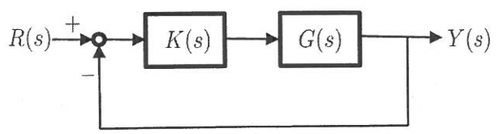
系所組別：1502 自動化科技研究所

第二節　自動控制　試題（選考）

注意事項：

1. 本試題共 4 題，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. Consider the unity feedback system shown below, where the plant $G(s) = \frac{1}{s(s+2)}$.



a) Find a proportional compensator so that the loop transfer function has a phase margin of $60°$. **(15%)**

b) What is the gain margin, the gain crossover frequency and the position error constant of the compensated system? **(10%)**

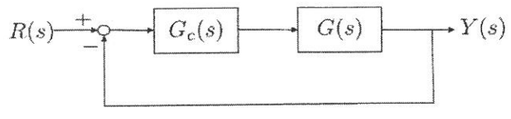
2. A plant, with the transfer function $G(s) = \frac{(100-s)}{(s+10)^2}$, accept a unit step command. Please sketch the output response in time domain roughly. **(10%)**

3. Consider the linear system as shown below, where $G(s) = \frac{1}{s-1}$ and $G_c(s) = K(s+2)$.

a) Sketch the corresponding complete Nyquist path. **(5%)**

b) Sketch the corresponding complete Nyquist plot. **(15%)**

c) Based on the Nyquist plot, please determine the range of K for which, if any, the closed-loop system is stable. **(10%)**



4. The equation of motion for the simple pendulum is $\ddot{\theta} + \omega^2\theta = u$.

a) Please write the equation of motion in state space form. **(5%)**

b) Design an observer (estimator) that reconstructs both states of pendulum given measurements $\dot{\theta}$. Assume $\omega = 5\ rad/s$ and pick the observer roots to be at $s = -10 \pm 10j$. **(10%)**

c) Write the transfer function of the observer between the measured vale of $\dot{\theta}$ and the estimated value of θ (or $\hat{\theta}$). **(10%)**

d) Design the state feedback controller $\boldsymbol{K}$ so that the roots lie in $s = -4 \pm 4j$. **(10%)**