110AT03

國立臺北科技大學 110 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：

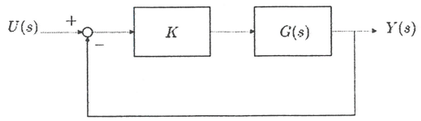
1. 本試題共 4 題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. A closed-loop system with unity feedback has a transfer function $T(s)=\dfrac{10(s+1)}{(s+1)^2+9}$

(a) Draw the Bode diagram for the **open-loop** transfer function $G(s)$ roughly, including magnitude and phase vs frequency with semilog scale for the frequency axis. **(20%)**
(b) What is the gain margin? **(10%)**

2. Consider the transfer function $G(s)=\dfrac{(100-s)}{(s+10)^2}$ with unity feedback. Please sketch the output response in time domain roughly. **(10%)**

3. Consider a closed-loop system shown in the figure



where $G(s)=\dfrac{10(s+1)}{s(s-3)}$.

(a) What are the closed-loop poles and zeros? **(2%)**
(b) Sketch the root locus. **(15%)**
(c) Find the unit-step response $Y(t)$. **(5%)**
(d) Calculate $Y(t)$ at 0, 1, ∞. **(3%)**

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 $s=-10\pm10j$. **(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 K so that the roots lie in $s=-4\pm4j$. **(10%)**