編號： 134

# 國立成功大學 109 學年度碩士班招生考試試題

系　　所：航空太空工程學系

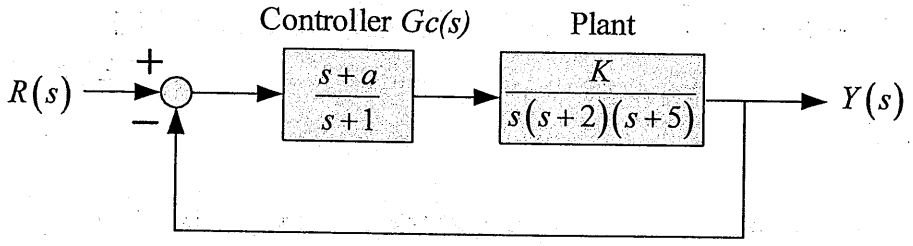
考試科目：自動控制

考試日期：0210，節次：1



※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Suppose that the design of a turning control for a tracked vehicle involves the selection of two parameters $a$ and $K$. The control block diagram is shown below.




(a). Please sketch the feasible region of $a$ and $K$ so that the system is stable.(5%)

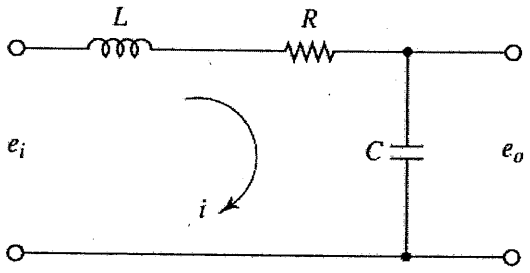
(b). Provide the condition for the selection of $a$ and $K$ so that the steady state is 24% of the magnitude of the command $r(t)$, where $r(t)=At$ and $A$ is a constant. (5%)

(c). For $a=10$, please draw the root locus. (5%)

(d). Based on (c), please find the break-in or break-away point if exists. (5%)

(e). Based on (c), please find the gain $K$ such that the system oscillates. (5%)

2. Consider the following resistor-inductance-capacitance circuit




where $e_i$ is the applied voltage input and $e_o$ is the voltage output.

(a). Please derive the electrical dynamics model and find the transfer function. (5%)

(b). Please represent the input $e_i$ and output $e_o$ in terms of a state-space form. (5%)

(c). Please find the condition so that the system meet the under damped condition. (5%)

(d). Is this circuit possible to act as an amplifier for a dc input? Please provide your reason and detail proof. (5%)

(e). Can we apply the circuit to work as a low-pass filter? If so, determine the cut-off frequency represented in terms of $R$, $L$ and $C$. (5%)

3. For the open-loop system

$$KG(s)=\frac{K(s+1)}{s^2(s+5)}$$

(a). For $K = 1$, Plot the Bode plot of $G(s)$. (10%)
(b). Determine the system phase margin, if the negative unity feedback system is stable. (5%)
(c). Sketch the root locus for $K > 0$. (10%)
(d). Determine the value of K such that the complex conjugate closed-loop poles have a damping ratio of 0.5. (10%)

4. Plot the Nyquist plot of the system $KG(s)$ with $K = 10$, also determine the intersection point of the Nyquist plot with the negative real axis. (10%) Determine whether the negative unity feedback system is stable using the Nyquist stability criterion. (5%)

$$KG(s)=\frac{K(s+10)^2}{s^2(s-1)}$$