國 立 臺 北 科 技 大 學

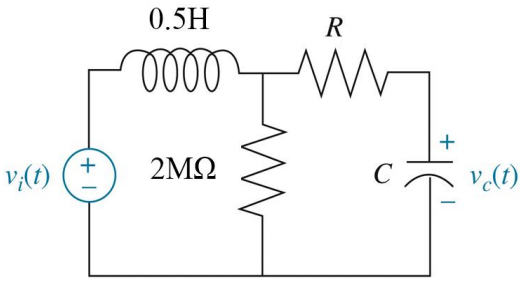
105 學年第二學期電機系博士班資格考試

控制系統(大學部) 試題

注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。
5. 可用計算機。

1. Considering the following network circuit.



10% (a) Find the transfer function $V_c(s)/V_i(s)$.

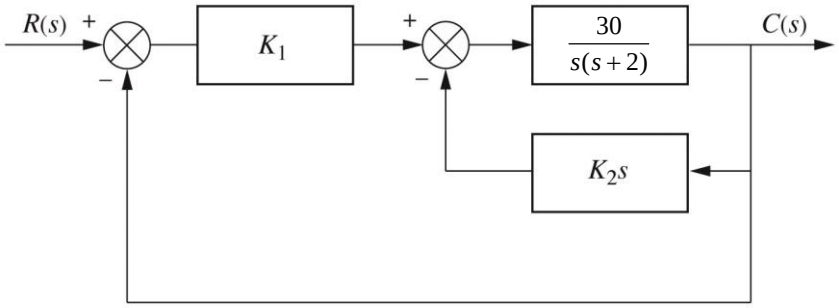
15% (b) If $C = 1F$, find the range of R such that the system is stable.

2. Given the unity feedback system with the plant $G(s) = \dfrac{K(s+2)}{s(s+10)(s^2+2s+2)}$.

15% (a) Sketch the root locus.

10% (b) Find the range of gain K for stability of the closed-loop system.

3. Considering the following system.



10% (a) Find the equivalent transfer function $C(s)/R(s)$.

15% (b) Find the ranges of K_1 and K_2 to keep the closed-loop system stable.

4. Consider a LTI state-space equation

$$\begin{cases} \dot{x}(t) = Ax(t) + Bu(t) \\ y(t) = Cx(t) + Du(t) \end{cases}.$$

10% (a) Show that the solution of this state-space equation can be derived as

$$x(t) = e^{At}x(0) + \int_0^t e^{A(t-\tau)}Bu(\tau)d\tau\,.$$

15% (b) If $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$, find e^{At} by using the Cayley-Hamilton theorem.