國 立 臺 北 科 技 大 學

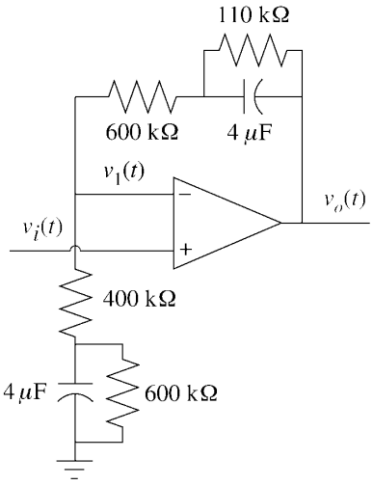
103 學年第二學期電機系博士班資格考試

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 operational amplifier circuit.



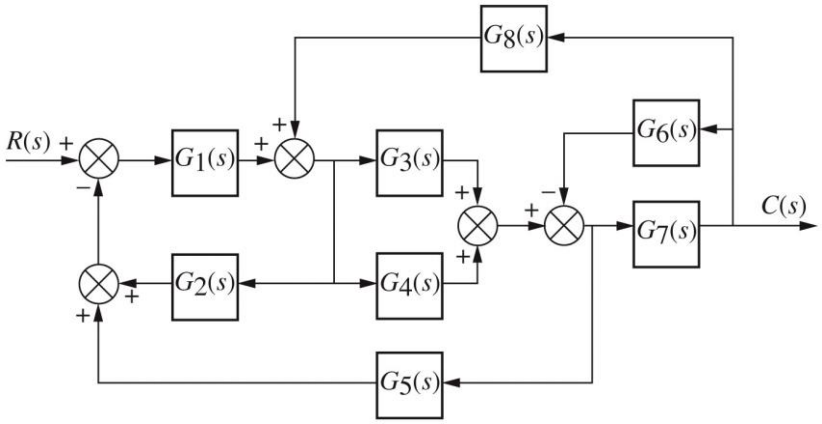
10% (a) Find the transfer function $V_o(s)/V_i(s)$.

5% (b) If $v(t) = u(t)$, find the step response $v_L(t)$.

5% (c) State the nature of step response (undamped, underdamped, critically damper, or oversamper).

5% (d) Determine whether the system is stable. Justify your answer.

2. Considering the following system.



15% (a) Find the equivalent transfer function $C(s)/R(s)$.

15% (b) Let $G_1(s)=\frac{1}{s},\ G_2(s)=1,\ G_3(s)=1,\ G_4(s)=1,$

$$G_5(s)=\frac{5}{s+7},\ G_6(s)=1,\ G_7(s)=\frac{3}{s+2},\ G_8(s)=\frac{1}{s+6}.$$

Determine whether the closed-loop system is stable. Justify your answer.

3. Given the unity feedback system with the plant $G(s)=\frac{K(s^2-2s+2)}{(s+1)(s+2)}$.

5% (a) Sketch the root locus.

15% (b) Find the breakaway points, the *jw*-axis crossing, and the angles of arrival in (a).

5% (c) Find the range of gain *K* for stability of the closed-loop system.

4. Given the unity feedback system with the plant $G(s)=\frac{100(s+1)}{s^2(s+10)(s+100)}$.

10% (a) Sketch the Bode plot (including the magnitude response and the phase response) of the open-loop system.

10% (b) Find the gain margin and phase margin of the open-loop system.